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INDIA WEATHER REVIEW, 1952

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

CONTENTS

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PART C

STORMS AND DEPRESSIONS

I. DEPRESSIONS AND CYCLONIC STORMS

During the year, 4 cyclonic storms and 11 depressions formed in the Bay of Bengal, one depression in the Arabian Sea and one depression over Chota Nagpur. The dates of activity of the storms and the greatest barometric depths observed near their centres are summarised in the following table:

TABLE 1

Locality	Month	Date	Greatest observed barometric depth
Bay of Bengal	May	20th-25th	15 mbs. (estimated)
Bay of Bengal	July	2nd-8th	12 mbs.
Bay of Bengal	November	8th-12th	20 mbs.
Bay of Bengal	November	26th November-1st December.	60 mbs. (estimated)

The detailed descriptions of these storms and depressions are followed by an account of western disturbances and the more important local storms and of the localities in which winds of force 9 or more unconnected with cyclonic storms were experienced by ships in the Indian Seas.

1. Depression in Bay of Bengal—16th-17th May.—On the 13th morning, ship Ziebadeer, Lat. 6°N., Long. 86½°E. reported at 0530 hrs. I.S.T. overcast skies, wind WSW 20 knots and squalls. Another ship Singu, near Lat. 6°N., Long. 86°E., also reported overcast skies with showers. These observations showed that the south-west monsoon was strengthening in the South Bay of Bengal. On the 14th evening, Nan-Cowrie reported WSW 30 knots wind, S.S. Rajula near Lat. 7½° N., Long. 90°E., reported W 20 knots wind with squalls and S.S. Nurjahan, Lat. 10°N., Long. 87½°E., northerly light wind. These observations showed that conditions had become unsettled in the southeast Bay by the evening of 14th.

On the 15th evening Car Nicobar reported W/WSW-ly winds of 35-50 knots up to about 7,000′ a.s.l. This showed that unsettled conditions had become more marked. A depression formed on the morning of 16th, centred about 70 miles south-southwest of Port Blair. Port Blair was at that time reporting ESE 30 knots. The depression moved north and began to weaken being centred at 17-30 hrs. I.S.T. of the same day near Lat. 12½°N., Long. 92°E., and at 08-30 hrs. I.S.T. of the 17th near Lat. 13½°N., Long. 91½°E. By the same evening, the depression had weakened into a trough of low pressure.

2. Severe cyclonic storm in Bay of Bengal—20th to 25th May.—The residual trough of the last depression persisted over the south and the adjoining central Bay for the following two days and on the 19th morning, a well marked cyclonic circulation was noticed over the south and central Bay up to about 7,000′ a.s.l. This showed that the trough was apparently intensifying again. On the 20th morning, Ship Makala at Lat.13° 30′N., Long. 82° 54′E., reported northeasterly 25 knots wind and S.S. Jalaratna at Lat. 11° 42′N., Long. 81° 48′E., reported westerly 15 knots wind and a depression had formed in the southwest Bay of Bengal centred at 0830 hrs. I.S.T. near Lat. 12½°N., Long. 83°E., with an estimated pressure defect of 9 mbs. at the centre. On the same afternoon S. S. Makala (Lat. 12°N., Long. 82½° E.) at 1730 hrs. I.S.T. reported northwesterly 50 knots wind indicating that the depression had remained stationary and intensified into a cyclonic storm probably of severe intensity.

By 0830 hrs. I.S.T. of the next day, it became a very severe storm with an inner core of hurricane winds. S.S. Dumosa near Lat. 13½°N., Long. 81°E., reported northerly wind of 70 knots and S.S. Trenbander about 30 miles south of S.S. Dumosa, NNW wind of 45 knots. S.S. Dumosa was evidently within the inner core of hurricane winds, with the centre of the cyclone close to Lat. 13½°N., Long. 81½°E. No direct evidence of the pressure defect at the centre is available but it is estimated to be about 15 mbs. The cyclone thereafter moved north and somewhat moderated. It was centred at 1730 hrs. I.S.T. of the 21st near Lat. 14½°N., Long. 81½°E., and Madras was then reporting westerly wind of 45 knots and S.S. Saranga at Lat. 12°36′N., Long. 80°48′E., westerly wind of 50 knots. At 0830 hrs. I.S.T. of the 22nd, it was centred about 70 miles south of Masulipatnam, when Nellore was reporting NW wind of 45 knots. Continuing to move northwards and weakening, it lay as a deep depression centred about 40 miles eastsoutheast of Masulipatnam on the morning of 23rd. It weakened rapidly during the course of the day and lay as a shallow depression centred about 70 miles east of Masulipatnam on the morning of 24th.

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Weakening further it lay as a trough of low pressure off coastal Andhradesa on the 25th morning and became unimportant during the course of the next day.

In association with the storm widespread and locally very heavy rain occurred in north Tamilnad on the 21st and 22nd and in south Hyderabad, Coastal Andhradesa and Rayalaseema between the 22nd and 26th. The observatories at Nungambakkam and Meenabakkam at Madras recorded 17″ and 13″ of rain respectively during the 48 hours ending at 0830 hrs. I.S.T. of the 22nd. Nellore had 13″ during the same period and Ponneri in Tamilnad recorded 14″ on the 22nd. Other noteworthy amounts of heavy rainfall were Kurnool 7″ on the 23rd and Gulbarga 5″ on the 24th. According to press reports, many low lying areas in Madras city were flooded on the 22nd and considerable damage was caused. The rivers Krishna and Pennar rose in spate causing breaches on the Southern Railway between Madras and Vijayawada. The cyclone, however, brought timely relief for the drought-affected areas of Tamilnad and Rayalaseema.

Under the influence of the above storm, the southwest monsoon was ushered in Travancore-Cochin on the 20th May—about 10 days before the usual date.

The noteworthy district averages and amounts of particularly heavy rainfall are given in the following table.

TABLE 2.

State and district	District average on 22nd	23rd	24th	Particularly heavy falls
Hyderabad				
Gulbarga	2·1	..	..	
Hyderabad	..	..	..	
Mahbubnagar	2·6	4·6	2·3	Kollapur 7·2″ on 22nd, Nagarkarnool 10·5″ on 23rd, Atmakaur 9·5″ on 23rd.
Nalgonda	.	.	.	
Raichur	..	2·0	..	Alampur 5.3″ on 22nd, 6.3″ on 23rd.
Warangal	..	..	..	

State and district	District average on 20th	21st	22nd	23rd	24th	Particularly heavy falls
Coastal Andhradesa						
Krishna	..	..	..	..	..	Puligedda 4·9″, Nimmagadd″ 5·7″, Guruvindapalli 6·3 on 24th May
Guntur	..	..	..	..	3·5	Inturtock 5·7″, Kunchipundi lock 8·3″, Tenali 6·5″, Repalli, 12·1″, Ponnur 5·5″, Jaganalmudi lock 4·5″, Kollimenalelock 5·7″, Adivipalam lock 4·5″, Morthotalock 5·5″, Vellatur lock 5·7″, Kollurur lock 5·6″ on 24th May.

TABLE 2—*contd.*

State and district	District average on 20th	21st	22nd	23rd	24th	Particularly heavy falls
Coastal Andhradesa—contd.						
Nellore	2·7	2·5	2·2	..	..	On 20th Nellore 7·3″, Sulurpet 12·1″, Atamakur 6·5″, Karali 4·8″, Isakapalle 7·1″, Krishnapatnam 7·5″ Tada 9·3″, Nellore 5·6″, Atmakur 5·0″, Kanigiri 5·8″, Kavalie 6·0″, Krishnapatnam 7·7″, Pambli 8·8″ on 21st.
						Nellore Anicut 5·7″, Narukuru 5·6″, Survepalli 12·7″, Buchireddipalem 5·7″, Sangam 5·2″, Mopadu 4·5″ on 22nd.
						Survepalli 8·7″, Buchireddipalem 4·6″, Modpadu 5·1″ on 23rd.
Rayalaseema						
Cuddapah	..	..	..	3·3	..	Chitvel 5·4″, Kodur 5·5″ on 22nd. Badvel 9·7″ Vanipenta 5·6″, Porumanilla 9·0″ on 23rd.
Chittor	..	..	..	2·3	..	Bhakarapet 5·9″ on 21st, Puttur 7·6″, Kalahasti 9·3″, on 22nd.
Kurnool	..	..	..	..	4·4	Markapur 4·5″, Cumbum 5·1″, Giddalore 7·1″, Allagadda 9·1″, Nandyal 15·3″, Koilkuntla 7·6″, Nandikotkur 10·1″, Kurnool 6·5″, Peapalli 4·9″ Banganapalli 5·9″, Lockinsula 4·6″, Siddapuram 7·1″ on 23rd.
						Nandikotkur 5·0″, Kurnool 4·5″ on 24th″ Dhone 4·6 Maddikera 4·6″ on 25th
Anantapur	..	..	..	..	..	Gooty 5·1″ on 23rd.
Tamilnad						
Madras	..	..	6.6	8.7	..	Nungambakam 7·2″ on 21st 9·6″ on 22nd, Chepauk 6·1″ on 21st and 7·7″ on 22nd.
Chingleput	..	..	4.1	5.7	..	Athipet 6·8″, Covelong 5·1 Meenambakkam 5·5″, Saidapet 4·8″, Ponneri 5·6″, Sattiavedy 5·6″, Red Hills 5·8″, Cholavaram 4·9″ Vallur 5·3″, Voyalur 7·8″ Chembarambakkam 4·6″ on 21st May; Athipet 9·6″, Ponneri 13·7″ Covelong 5·3″ Meeambakkam 7·5″ Saidatep 6·5″
Chingleput	..	..	..	..	..	Sathiavedu 5·4″, Voyalur 10·4″, Tiruvallur 5·0″, Poonamallee 4·6″, Red Hills 12·1″, Cholavaram 9·6″, Vallur 15·9″, Tamarapauk 7·7″ Chembarambakkam 6·1″, Kesavaram 5·1″ on 22nd May.

3. Depression in the Bay of Bengal—24th to 27th June.—On 22nd morning an appreciable fall in pressure was observed over north Burma and neighbourhood and by the evening of the day, a low pressure wave was noticed to be moving westwards across the Arakan-Chittagong coasts. On the 23rd morning, an upper air cyclonic circulation started developing over the north Bay of Bengal and became more marked in the evening. This showed that conditions were unsettled in the north Bay. The unsettled conditions concentrated into a shallow depression centred at 0830 hrs. I.S.T. of the 24th about 40 miles northeast of Sandheads. The depression moved

northwestwards and lay near Saugor Island on the morning of 25th. It had deepened by this time. The depression crossed the Sundarbans coast during the following night and lay with its centre midway between Midnapore and Jamshedpur on the 26th morning. The depression weakened after the 26th morning and continuing to move nothwestwards, lay over southwest Bihar and adjoining east Uttar Pradesh on the 27th morning and over east Uttar Pradesh in the same evening. On 28th morning it lay as a diffuse low pressure area over the central parts of Uttar Pradesh. The low pressure area however became more marked by the 29th morning. It, then, moved gradually in a northeasterly direction and became unimportant over northeast Uttar Pradesh by the morning of 1st July.

Under the influence of the above depression, active monsoon conditions prevailed in northeast India between the 26th June and 1st July. Locally very heavy rain occurred in Madhya Bharat between the 26th and 29th, with a total rainfall of about 24″ in Gwalior and neighbourhood during this period. According to press reports, these heavy rains flooded the low lying areas, damaged houses and dislocated means of communication in Gwalior town. Locally heavy to very heavy rain also occurred in east Uttar Pradesh on the 30th.

A table showing the noteworthy district averages of rainfall as well as the amounts of particularly heavy rainfall that occurred in association with the above depression is given below:

TABLE 3

State and district	District average on June 24th	25th	26th	27th	28th	29th	30th	July 1st	Particularly heavy falls
West Bengal									
West Dinajpur	..	..	..	2·3	2·4	2·9	2·7	..	
Jalpaiguri	..	..	..	..	2·1	3·5	4·1	..	On 29th Kumargram 6·5″; On 30th Alipurdwar 5·9″, Kumargram 5·8″.
Darjeeling	1·7	..	..	2.6	..	3·4	2·4	1·9	On 29th Bagdogra 6·9″.
Malda	..	..	..	..	..	4·1	2·6	..	On 29th Malda 5·2″, Gazole 5·2″.
Cooch Behar	..	..	..	..	..	2·1	..	..	
Madhya Pradesh									
Jabalpur	..	..	..	..	..	..	..	..	On 27th Borina 5·1″.
Uttar Pradesh									
Dehra Dun	..	..	..	..	..	1·8	..	..	
Aligarh	..	2·9	..	..	..	..	..	..	
Agra	..	1·7	..	..	1·7	..	1·6	..	
Mainpuri	5·4	..	..	..	..	..	..	..	On 24th—Mainpuri 7·9″, Mainpuri (obsy) 7·5″, Mustafabad Jasrana 8·0″, Shikohabad 5·1″, Gopalpur 5·7″.
Etah	3·0	..	..	..	..	..	..	..	
Budaun	..	3·0	..	..	..	..	..	..	
Shahjahanpur	1·7	1·5	..	..	..	..	..	..	
Farrukhabad	1·8	..	..	..	..	1·7	..	..	
Etawah	..	..	..	..	..	2·2	2·4	..	
Kanpur	..	..	..	..	..	2·3	2·4	..	On 30th Bilhaur 6·6″.
Fatehpur	..	..	..	..	..	..	1·8	..	
Jhansi	..	..	1·9	..	..	2·9	..	..	On 26th Lallipur 7·2″. On 28th Magarwara 6·0″. On 29th Moth 5·7″, Magarwara 6·6″.
Jalaun	..	..	..	..	..	3·6	2·2	..	On 29th Orai (obsy) 9·3″.
Hamirpur	..	..	..	..	..	1·8	..	..	On 29th Hamirpur 6·0″
Banaras	..	..	..	..	1·6	..	..	..	
Mirzapur	..	..	..	2·4	..	..	..	..	On 27th Robertsganj 6·0″.
Gorakhpur	2·3	..	..	..	..	..	..	..	
Deoria	..	2·1	..	..	1·6	..	1·6	..	On 25th Deoria 5·9″.
Tehri-garhwal	..	..	..	..	..	1·9	..	..	
Lucknow	..	..	..	..	5·2	..	2·5	..	On 28th Lucknow 5·2″, Lucknow (obsy) 5·1″, Malihabad 7·5″.
Unnao	..	..	..	..	..	..	2·8	..	
Rae Bareli	..	..	..	..	..	..	2·1	..	

TABLE 3—*contd.*

State and district	District average on June 24th	25th	26th	27th	28th	29th	30th	July 1st	Particularly heavy falls
Uttar Pradesh—contd.									
Sitapur	2·4	..	..	..	2·6	..	5·8	..	On 30th Biswan 10·3″, Sidhauli 5·2″.
Hardoi	2·3	..	..	..	2·3	2·1	3·3	..	On 24th Hardoi (obsy) 5·1″; On 30th Hardoi (obsy) 5·3″.
Kheri	..	..	2·2	..	..	..	2·2	..	
Gonda	..	..	..	..	..	..	2·5	2·2	
Bahraich	..	..	..	..	..	..	6·4	..	On 30th Bahraich 6·7″; Bahraich (obsy) 6·0″; Nanpara 8·8″.
Sultanpur	..	..	1·8	..	..	..	2·0	..	
Pratapgarh	..	..	3·0	..	2·4	..	2·1	..	On 26th Pratapgarh 8·0″.
Bara Banki	..	..	..	..	3·1	..	6·8	..	On 28th Nawabganj 6·1″; On 30th Nawabganj 9·3″, Fatehpur 10·8″, Haidergarh 5·2″.
Basti	..	..	..	..	..	..	..	1·7	
Faizabad	..	..	..	..	..	..	..	1·8	
Bihar									
Champaran	..	..	..	..	..	..	1·5	..	
Muzaffarpur	..	..	..	..	..	1·8	..	..	On 29th Shehar 7·0″.
Purnea	..	..	..	..	..	..	..	..	On 28th Bhahadurganj 5·0″; On 29 Bhahadurganj 5·4″.
Ranchi	..	..	..	..	..	..	..	..	On 29th Bharno 7·0″.

4. Cyclonic storm in the Bay of Bengal—2nd to 8th July.—On 1st July, a low pressure wave was noticed moving across central Burma into the north Bay of Bengal; pressures were falling rapidly over central Burma and the Arakan-Chittagong coasts and were already 2—3 mbs. below normal over these regions. By the next morning, conditions became unsettled in the north Bay; pressures had commenced rising over the eastern parts of Burma, but were falling on the coastal areas around the north Bay. Akyab reported E/5K wind and Sandheads NNE/2K wind at 0830 hrs. I.S.T. on the 2nd. The unsettled conditions concentrated into a shallow depression by 1730 hrs. I.S.T. on the 3rd; Sandheads reported ENE/12K wind and S.S. Billiton (18°48′N., 87°6′E.) W/15K wind, thus placing the centre near Lat. 20°N., and Long. 88°E. Intensifying rapidly during the course of the night, the shallow depression became a cyclonic storm by 0830 hrs. I.S.T. of the 4th, when it was centred close to Saugor Island but to the south of it. Saugor Island reported ENE/50K wind, Sandheads NW/20K., Contai NE/20K wind and Balasore NNW/10K wind. The storm was thus of small core and Saugor Island was apparently within the inner core. Pressure deficiency at Saugor Island was 12 mbs. and that at Sandheads 11 mbs.; the pressure defect at the centre may well have been of the order of 15 mbs. The storm crossed the coast by noon near Contai and weakened into a deep depression which lay at 1730 hrs. I.S.T. on 4th over north Orissa with centre about 50 miles north of Balasore. Extracts from weather diaries of Sandheads, Saugor Island, Balasore and Contai given below may be found to be of interest in this connection.

Sandheads—3rd July.—Sky overcast with 5 octas Cu and 3 of Sc at day break by 0830 hrs. Cu alone more than ¾ Covered sky. As day progressed C_L decreased and 1 to 2 octas Ac and 1 of Ci were observed for about 1½ hrs. By 1330 hrs. As began to cover the sky and by evening sky overcast mainly with As or Ns and 2—3 octas Fc, light precipitation occurred before 1730 hrs. and heavy rain occurred at 1800 hrs. C_M persisted all evening. Vis. fair; round by, light sea haze, poor in rain. Wind mainly NNE/E force 2 by day, force 3-5 by night. Slight sea swell by day; moderate sea swell by night.

4th July.—Day broke dull and stormy. Sky overcast with 3 octas Fc, 2 of Fs and a grey background of Ns. Light to moderate precipitation early morning. Bar had been dropping steadily all previous day but from midnight slow drop observed. Wind varied between NNE and NNW morning. By 0945 cyclone hit Sandheads. Wind moved suddenly to S and reached gale force and over; and sky overcast with Ns. Heavy precipitation occurred for over an hour. By 1130 hrs. rain ceased and wind and sea became moderate. By 1600 hrs. sky brightened. Cu 5 octas Ci being observed. Vis. moderate round by sea haze, poor in rain. Wind-SSW—S during storm, force 7, SW force 5 rest of the day. Heavy sea and swell during storm. Moderate sea but heavy swell thereafter.

Saugor Island—4th July.—Early morning sky still overcast with Fb from NE with rain from 1730 hrs. vis. poor, wind NNE force (4) remained cloudy whole day. Wind and rain began to increase thereafter and weather became worse with wind ENE force (9) strong gale wind direction changed to SSW force (8) fresh gale-rain from 1130—1230 continued till 1630 hrs. wind force began to decrease. Conditions unchanged until 0000 hrs.

Balasore—4th July.—Sky completely overcast with Fs. throughout the day. Moderate to light rain from 0540 to 0830 hrs. Continuous light rain 0830 hrs. to 1145 hrs. There was heavy rain up to 1210 hrs. Again there was continuous light rain up to 1650 hrs. There was also heavy rain from 2235 hrs. Light rain up to midnight. Light to moderate wind mainly from NW and WNW in forenoon and from SW in afternoon. Good visibility throughout the day.

Contai—4th July.—Fc^3 Ac^2 Cu^2 in morning St^3 in evening. Wind blew from NW in the morning about 1140, wind from SE then changed to SW force 50 in evening. Again changed into SE with rain. Cyclonic weather visibility bad.

The depression thereafter took a westnorthwesterly course and weakened as it moved. At 0830 hrs. I.S.T. on 5th July it was centred 40 miles south of Daltonganj and on the 6th, 20 miles south of Nowgong. It lay over north Madhya Bharat with centre about 80 miles SSW of Gwalior on the morning of the 7th and weakened into a shallow depression by that evening. Thereafter, it moved northwards and weakening further at the same time, lay as a "low" over northwest Uttar Pradesh where it became unimportant by the 8th evening. The storm caused widespread and locally heavy to very heavy rain along and near its track. The rains were particularly heavy in Madhya Bharat. A large number of state raingauge stations in Madhya Bharat reported rainfall ranging from 5″ to 10″ on the 6th and 7th, with exceptionally heavy falls of 17″ at Biaora and of 16″ at Rajgarh on the 7th. According to press reports, several villages in Madhya Bharat were submerged and communication was dislocated. Locally heavy falls also occurred in Orissa on the 5th, Vindhya Pradesh on the 6th, and in and around southeast Rajasthan on the 8th July.

A statement of district averages of rainfall and of particularly heavy falls that occurred in association with this storm is given below:

TABLE 4

State and district	District averages on July								Particularly heavy falls
	2nd	3rd	4th	5th	6th	7th	8th	9th	
Uttar Pradesh									
Dehra Dun	..	..	..	..	..	2·7	..	..	On 7th Dehra Dun (obsy) 5·8″
Fatehpur	..	2·1	..	..	..	..	..	..	
Madhya Pradesh									
Sagar	..	..	..	..	3·1	..	..	..	On 5th Hatta 9·0″; On 6th Banda 5·6″, Damoh 6·0″, Chandia Nallah 6·2″

NOTE.—Rainfall data from Orissa, Chota Nagpur, Vindhya Pradesh, Madhya Bharat, Southeast Rajasthan not available.

5. Shallow depression in the Bay of Bengal—19th-22nd July.—The seasonal trough of low pressure was observed to be extending into the Bay of Bengal on the 17th morning. From a rapid fall of pressure over east Pakistan and Arakan, it was apparent that a low pressure wave from the east was also moving into the north Bay on the 18th morning. By the 19th morning, conditions became markedly unsettled over the north Bay and in the evening of 19th, a shallow depression formed in the north Bay, centred near Lat. 20½°N., Long. 88½°E. The shallow depression took a westnorthwesterly course and was centred about 30 miles southeast of Balasore on the 21st morning. It had also somewhat deepened by that time. The shallow depression crossed the coast near Balasore by the same afternoon and was centred near Jharsuguda on the morning of 22nd. It weakened thereafter and lay as a 'low' over Chota Nagpur and neighbourhood on the 23rd morning. The 'low' merged into the monsoon trough in the course of the evening.

In association with the above depression fairly widespread rain with locally heavy falls occurred in Orissa between the 18th and 21st. The monsoon was also markedly active over the central parts of the country between the 19th and 23rd, particularly in east Madhya Pradesh on the 21st. Some of the noteworthy heavy rainfall amounts from east Madhya Pradesh on the 21st are given below:—

Durg 5·0″, Mahasamund (Raipur district) 6·8″, Bijapur (Bastar district) 6·5″.

6. Land depression—27th to 31st July.—A low pressure area appeared over Gangetic West Bengal on the 26th morning. It moved westwards and concentrated into a shallow depression on the 27th morning with its centre near Chaibasa. The depression took a westnorthwesterly course and was centred near Ambikapur on the 28th morning and between Umaria and Sutna on the 29th morning. On the 30th morning, it was centred midway between Sagar and Guna and on 31st morning it was near Guna. It weakened and became unimportant by the evening of 31st.

Under the influence of the depression, the monsoon remained markedly active in the central parts of the country. Very heavy rainfall was reported from a number of stations along and near its track, the rainfall being exceptionally heavy in Madhya Bharat on the 30th and in extreme north Gujarat on the 31st. Ratlam recorded 10″ of rain on the 30th and Mount Abu 11″ on the 31st. According to newspaper reports, floods were caused in Kaira and Ahmedabad districts of Gujarat and there was also a serious dislocation of railway and air communications.

A statement of district averages and noteworthy amounts of heavy rainfall occurred during the period of the depression is given below.

TABLE 5

State and district	District average on 26th	27th	28th	29th	30th	31st	Particularly heavy falls
Bihar							
Damodar Catchment area.	1·7	..	..	..	..	..	Paliganj 5·4″ on 28th.
Ranchi	1·6	..	..	..	..	..	
Singhbhum	3·3	..	..	..	..	..	Chakradharpur 6·0″ on 26th; Jamshedpur 7·4″, Chibasa 5·6″, Chakradharpur 5·0″, Saraikella 6·0″ on 27th; Sonua 8·6″ on 28th.
Madhya Pradesh							
Raipur	..	..	2·2	..	..	..	Pithora 5·6″ on 28th.
Raigarh	1·9	4·5	1·5	..	..	..	Raigarh 5·4″, Jashburnagar 6·4″, Raigarh Obsy. 7·0″ on 28th.
Bastar	..	..	1·6	..	..	..	
Sagar	..	..	1·9	2·0	..	..	Surajpur 5·1″ on 28th.
Jabalpur	..	..	2·7	1·8	..		Bahosilbund 7·0″ on 28th.
Mandla	..	1·5	1·7	..	..	..	
Balaghat	..	..	..	..	..	..	Paraswada 5·1″ on 29th.
Hoshangabad	..	..	..	3·2	..	..	Pachmarhi 7·4″ on 29th.
Bilaspur	..	1·9	2·9	..	..	..	Champa obsy. 5·6″, Katghera 5·2″ on 28th Korba 5·9″ on 27th; Sheorinarayan 5·2″ on 27th; Dhabra 5·0″ on 26th.

TABLE 5—*contd.*

State and district	District average on 26th	27th	28th	29th	30th	31st	Particularly heavy falls
Gujarat							
Banaskantha	4·5	3·7	..	..	..	1·9	Abu Road 5·8″ on 26th Tharad 5·9 on 27th.
Mehsana	3·2	..	..	..	..	..	Mehsana 8·1″ on 26th.
Sabarkantha	2·0	..	..	..	2·4	3·0	Idar 6·7″ on 31st.
Ahmedabad	2·3	..	..	..	..	..	Aslali 5·7″ on 26th.
Kaira	3·8	..	..	..	1·7	..	Anand 7·8″ on 26th; Nadiad 7·1″ on 27th.
Panchmahals	4·0	..	..	1·6	5·7	5·2	Baria 8·9″ on 26th; Lunavada 5·6″ Jhalod 10·4″, Sant 10·3″ on 30th; Jhalod 10·8″, Dohad 5·7″, Mount Abu obsy. 11″ on 31st.
Baroda	2·4	..	..	..	3·4	2·0	
Surat	1·9	..	..	..	..	..	Dharanpur 5·2″ on 26th.

In addition to the above mentioned falls, Ratlam in Madhya Bharat also recorded 10″ of rain on the 30th morning.

7. Shallow depression in the Bay of Bengal—31st July to 4th August.—On the 29th morning, pressure changes were positive practically all over India, while they were negative over upper Burma, suggesting that a low pressure wave was affecting upper Burma on the 29th morning. The monsoon was also strong along the Chittagong coast on that day, Cox's Bazar reporting 7″ of rain and Chittagong and Barisal 4″ each. On the 30th morning, pressures started falling over the Arakan-east Pakistan coasts and an upper air cyclonic circulation also developed over the head Bay. These showed that the low pressure wave from the east had moved into the north Bay and that conditions were unsettled there. By the 31st morning, the unsettled conditions concentrated into a shallow depression over the head Bay with centre near Lat. 21½°N., Long. 90°E. Moving westwards, it deepened somewhat and was centred at 0830 hrs. I.S.T. on 1st August about 40 miles east of Contai. Saugor Island then reported WSW/25 knots and Sandheads W/18 knots, the pressure defect at the centre being now about 10 mbs. The depression was crossing the coast near Contai on the 2nd morning. Weakening and continuing its westerly course, it again lay as a shallow depression centred near Jharsuguda on the 3rd morning. Thereafter it took a westnorthwesterly course and lay over north Madhya Bharat and adjoining southeast Rajasthan on the 4th with its centre midway between Guna and Sagar. It further weakened into a low pressure area on the 5th morning and became unimportant in the course of the next 24 hours.

In association with the above depression, fairly widespread rain occurred in Gangetic West Bengal, Chota Nagpur and north Orissa between the 31st July and 2nd August and in Madhya Pradesh on the 3rd and 4th August. Locally very heavy falls occurred in northeast Madhya Pradesh and adjoining Orissa on the 3rd August and in west Madhya Pradesh on the 4th. Fairly widespread rain with locally heavy falls also occurred in and near southeast Rajasthan on the 5th and 6th. Important district averages and noteworthy amounts of heavy rainfall are given in the following table.

TABLE 6

State and district	District average on 31st July	1st Aug.	2nd	3rd	4th	5th	6th	Particularly heavy falls
Gujarat								
Banaskantha	1·9	1·7	..	..	..	..	..	
Sabarkantha	2·9	1·6	..	3·0	1·7	..	..	Idar 6·7″ on 31st
Kaira	1·5	1·6	..	..	..	..	..	
Panchmahals	5·2	..	..	..	..	..	..	Dohad 5·7″, Jhalod 10·8″, Sant 9·9″ on 31st.
Bihar								
Singhbhum	..	1·7	1·7	..	..	..	..	
Manbhum	..	..	..	..	..	..	..	Chandil 7·8″ on 1st.
West Bengal								
24 Parganas	1·5	..	..	..	..	..	..	
Midnapore	1·9	1·9	..	..	..	..	..	Danten 5·9″ Gopiballavapur 5·0″ on 31st.
Howrah	1·6	1·8	..	..	..	..	..	
Madhya Pradesh								
Bilaspur	..	..	..	2·4	..	..	..	Pondilafa 6·0″, Katghora 3·7″ on 3rd.
Chanda	..	..	1·8	3·6	..	..	..	Brahmapuri 6·2″ Armosi 6·1″, Dhanora 6·5″ on 2nd. Gadhchinoli 6·8″ Asola 7·2″, Khairee 8·1″ Nalesar 6·4″, Garmusi 6·7″, Sindiwahu 6·7″ on 3rd.
Bhandara	..	..	..	2·2	..	..	..	Paon 5·6″ on 4th.
Balaghat	..	..	..	..	..	..	..	Lanji 5·7″ on 3rd.
Hoshangabad	..	..	..	2·9	..	..	..	Shohagpur 6·1″, on 4th.
Nimar	..	..	..	1·9	..	..	..	
Betul	..	..	..	1·6	..	..	..	
Chindwara	..	..	..	2·4	..	..	..	Tamia 6·2″ on 4th.
Nagpur	..	..	..	1·8	..	..	..	
Akola	..	..	..	2·2	..	..	..	
Amravati	..	..	..	2·2	..	..	..	
Buldhana	..	..	..	1·7	..	..	..	
Yeotmal	..	..	..	3·2	..	..	..	Yeotmal 6·8″, Yeotmal obsy. 6·5″ on 4th.

8. Depression in the Bay of Bengal—13th to 15th August.—On the 11th morning, the seasonal trough over the Gangetic plains was observed to have extended into the northwest angle of the Bay. A low pressure wave was also noticed to be moving westwards across the Burma coast into the north Bay. By the 12th morning, a well-marked low pressure area appeared over the northwest Bay and the adjoining areas of West Bengal and Orissa. Pressures were falling generally over the country but with a greater fall in and around the head Bay of Bengal, where negative pressure departure of the order of 4—5 mbs. was already existing. By the 13th morning, a depression formed with centre at 0830 hrs. I.S.T. about 80 miles south of Calcutta. Saugor Island reported NNW/14 knots, Contai N/6 knots and Alipore ENE/12 knots and gusty. Moving in a westerly direction, it lay close to coast near Balasore in the same

evening and was centred at 0830 hrs. IST on the 14th about 30 miles northeast of Jharsuguda. By the evening of 14th the depression weakened into a diffuse low which lay on the 15th morning over northeast Madhya Pradesh and adjoining Vindhya Pradesh; it became unimportant by the next morning.

The depression gave widespread rain in Gangetic West Bengal, north Orissa, Chota Nagpur, east Madhya Pradesh and Vindhya Pradesh between the 13th and 16th and locally heavy falls in north Orissa on the 14th and in northeast Madhya Pradesh on the 16th. Sambalpur recorded 6″ of rain on the 14th.

9. Shallow depression in the Bay of Bengal—19th to 22nd August.—A well-marked 'low' appeared in the north and adjoining central Bay on the 19th morning. Widespread rain had fallen on the West Bengal coast; Saugor Island recorded 4″ and Sandheads 3″. Upper winds from stations on the Orissa, West Bengal, east Pakistan and Burma coasts showed a cyclonic circulation up to 7,000 ft. a.s.l. By the next morning, a shallow depression formed with centre near Lat. 19½°N., Long. 88½°E. S.S. Jalamani (Lat. 18°54′N., Long. 87° 6′E.) reported westerly light wind, S. S. Tasang (Lat. 19°30′N., Long. 89° 12′E) S/10 knots and Sandheads NE/7 knots. The shallow depression moved northwestwards and crossed the Orissa coast near Chandbali on the 20th-21st night and was centred at 0830 hrs. I.S.T. on the 21st about 50 miles northeast of Angul. It weakened thereafter and merged into the seasonal trough by the next morning. Under its influence locally heavy falls occurred in Orissa in the 24 hours ending at 0830 hrs. I.S.T. on the 21st.

10. Depression in the Bay of Bengal—4th to 10th October.—A well-marked low pressure area lay over the Andaman Sea and neighbourhood on the 1st morning, when Kondul reported 6″ of rain. The low pressure area gradually moved westwards. A ship "Empire Trooper" near Lat. 5½°N., Long. 89°E., reported squalls at 1130 hrs. I.S.T. on 2nd. Westerly winds of 20-25 knots with showers were reported by a number of ships in the southwest Bay on the 2nd evening. These showed that conditions were rapidly deteriorating in the south Bay. By the 3rd evening, the ship 'Empire Trooper' which was then near Lat. 5½°N., Long. 83½°E., experienced WSW wind of 30 knots and another ship "Drowsey" near Lat. 3°N., Long. 82½°E., westerly 20 knots with squalls. Trincomalee reported 6″ of rain within the 9 hours ending at 1730 hrs. I.S.T. of the same date. Minicoy winds were westerly 30 to 35 knots up to 5,000 ft. a.s.l. The above observations showed that a strong current of equatorial maritime air was prevailing in the extreme south Bay, south of Lat. 8°N.

On the 5th morning, the low pressure area was located over the west central and adjoining southeast Bay of Bengal and coastal stations from Madras to Gopalpur had started raining. The low pressure area concentrated into a depression on the 6th morning, centred near Lat. 14°N., and Long. 84°E. S.S. Jalaprabha near Lat. 12½°N. and Long. 84°E., reported squalls on the same morning. The depression moved northwards and was centred on the 6th afternoon near Lat. 15°N., Long. 84°E. Pressures were then falling steadily along the Orissa coast and rainfall had extended up to Sandheads. The depression was centred on the 7th morning near Lat. 16½°N., Long. 84½°E. Fairly widespread heavy rain fell on the Circars and Orissa coasts between the 6th and 7th morning; Kakinada reported 8″ of rain, Gopalpur 5″ and Visakhapatnam and Calingapatam 4″ each. The depression remained practically stationary thereafter and weakening, lay as a low pressure area off the Orissa-Circars coast on the 8th morning. Rainfall had by then extended to the whole of northeast India outside Bihar. Locally heavy falls again occurred on the Orissa coast and also extended to West Bengal coast. Gopalpur recorded another 4″ of rain on the 8th morning, in addition to 5″ on the previous day while Balasore had 7″, Chandbali 6″, Puri 5″, Asansol 4″ and Contai, Saugor Island and Cuttack 3″ each. The low pressure area then moved inland and lay over Chota Nagpur on the 9th morning. Recurving thereafter, the "low" moved to Gangetic West Bengal by the 10th morning and passed away northeastwards during the course of the next 24 hours. Widespread rain again occurred over northeast India outside Bihar on the 9th and 10th.

A statement showing district averages of rainfall and particularly heavy rainfall amounts is given below:

TABLE 7

State and district	District average on 4th	5th	6th	7th	8th	9th	10th	11th	12th	Particularly heavy falls
West Bengal										
24 Parganas	..	..	..	..	1·7	..	1.6	..	..	Saugor Island 5·4″ on 10th.
Nadia	..	..	..	..	2·4	..	..	..	..	Haringhata 5·7″ on 8th.
Bankura	..	..	..	..	..	..	..	..	..	Saltora 5.1″ on 10th.
Midnapur	..	..	..	..	1·5	..	..	..	..	Contai 5.4″ on 10th.
Hoogly	..	..	..	..	..	1.8	..	..	..	
Howrah	..	..	..	..	2·4	..	..	..	..	
West Dinajpur	..	..	..	..	2·0	..	..	..	..	
Andhra										
Srikakulam	..	..	..	3·6	..	..	..	..	..	Srikakulam 6·8″, Pathapatnam 6·1″ on 7th.
Visakhapatnam	..	..	..	3·0	..	..	..	..	..	Gajapatinagaram 5·0″ on 6th; Konada 5·0″, Bheemunipatnam 7·1″ on 7th.
East Godavari	..	..	..	2·7	..	..	..	..	..	Kakinada 7·5″ Annampelle 5·3″, Chintalapudi 7·0″, Villa Lock 5·8″, Kakinada (P.W.D.) 6·5″ on 7th Bhadrachalam 5·3″ on 12th.
Madras										
Madras	3.2	..	..	..	..	..	..	..	..	

TABLE 7—*contd.*

State and district	District average on									Particularly heavy falls
	4th	5th	6th	7th	8th	9th	10th	11th	12th	
Madras—contd.										
North Arcot	..	..	..	..	..	..	..	..	..	On 7th—Aliabad Anicut 5·5″.
Nilgiris	..	..	..	..	..	..	..	...	..	On 9th—Devala 5·3″
Kurnool	..	..	..	..	..	..	..	..	..	On 11th—Kollimigunda 5·0″.
Travancore-Cochin										
Kottayam	2·2	..	..	..	..	..	..	..	..	On 4th—Malayattur 5·4″, Muvattupuzha 5·5″, Peermade 5·1″.
Quilon	1·7	1·9	..	..	..	..	..	..	..	On 5th—Quilon 5.1″.
Trivandrum	..	2·4	2·5	..	..	..	..	..	..	On 4th—Parasala 5·9″; On 5th—Nayyattinkara 5·9″ Kuchithurai 5·1″; on 6th Chorlakode 5·9″, Pechipara 5·1″, Thadikarankonam 5·0″, Mekod 6·0″.
Cochin	2·8	..	..	..	..	..	..	..	..	
Malabar	..	..	..	..	2.6	2.5	..	..	..	On 6th Iritty 6·5″; on 8th—Vyaithiri 7·7″, Lakkidi 10·9″ Tagarapady 8·9″; on 9th Quailandy 5·9″, Triprayar 6·1″, Lakkidi 10·6″, Tagarapady 9·1″.
South Kanara	..	..	..	..	..	2·0	3·1	3·2	3·7	On 4th Hosdrug 5·0″; on 10th Beltangady 5·0″; on 11th Mulki 7·5″, Kerkal 6·1″; on 12th—Udipi 8·1″.

11. Shallow depression in the Bay of Bengal—14th to 16th October.—Under the influence of a low pressure wave from the east, conditions became unsettled in the central Bay on the 13th evening. The unsettled conditions became more marked by the 14th evening and an upper air cyclonic circulation developed over the central Bay up to about 10,000 ft. a.s.l. On the 15th morning, a shallow depression formed in the west central Bay, centred at 0830 hrs. I.S.T. near Lat. 14½°N., Long. 84½°E. The shallow depression moved westwards and was centred near Lat. 14½°N., Long. 83°E., at 1730 hrs. I.S.T. of the same day. Moving in a northwesterly direction thereafter, the depression lay centred near Lat. 15½°N., Long. 81½°E., at 0830 hrs. I.S.T. of the 16th. It crossed coast on the following night between Ongole and Masulipatam and weakening, lay as a diffuse low over coastal Andhradesa on the 17th morning. The low became unimportant by the next day.

Under the influence of the above shallow depression, fairly widespread rain occurred along the Circars coast on the 15th and local to fairly widespread rain in Orissa, east Madhya Pradesh, east Hyderabad and coastal Andhradesa on the 16th and 17th.

12. Depression in the Bay of Bengal—19th to 22nd October.—A low pressure wave from the east was noticed moving across the south Tenasserim on the 16th morning. By the next morning, it moved into the north Andaman Sea, where an upper air cyclonic circulation developed up to a height of 10,000 ft. a.s.l. Pressures were falling generally and the stations on the Tenasserim coast had a negative pressure departure of 4 to 5 mbs. The upper air cyclonic circulation became more pronounced on the 18th morning and there was a strengthening of upper winds at Rangoon, Port Blair and Victoria Point. Widespread rain occurred in the Bay Islands, Long Island reporting 5″ of rain. These observations showed that on the 18th morning conditions were markedly unsettled in the north Andaman Sea and adjoining southeast and east central Bay of Bengal. The unsettled conditions concentrated into a depression by the 19th morning, centred near Lat. 15° N., Long. 92°E. Table Island was then experiencing southerly wind of 25 knots and Maya Bandar southwesterly 20 knots. Both Rangoon and Tavoy reported 3″ of rain on the 19th morning. Moving in a northnorthwesterly direction, the depression lay centred near Lat. 17°N., Long. 91°E., on the 20th morning. A ship 'Warla' near Lat. 18½°N., Long. 93°E., reported squalls and SE 20 knots wind at 1130 hrs. I.S.T. of the 20th. On the 21st morning, it was centred near Lat. 19½°N., Long. 91°E., Cox's Bazar reported 4″ of rain. It began to show signs of weakening on the same afternoon, probably because a deep low over south Indo-China caused a diversion of winds from the field of the depression. By the 22nd morning, the depression became shallow and was centred near Lat. 20½°N., Long. 90½° E.; local rain fell in Assam and east Pakistan. Weakening further, it moved inland as a low pressure wave on the 23rd morning, causing local rain in coastal West Bengal and Assam.

13. Deep depression in the Bay of Bengal—23rd and 24th October.—A low pressure wave from the east was noticed moving westwards across the Tenasserim coast on the 22nd morning. Pressures were falling rapidly on the Tenasserim coast, Tavoy recording a pressure deficiency of 8 mbs. Victoria Point recorded a rainfall of 4″ and Car Nicobar 3″. By the evening of the same day the low pressure wave moved into the north Andaman Sea, where conditions became markedly unsettled. By 0130 hrs. I.S.T. of 23rd the unsettled conditions concentrated into a depression with centre near Lat. 14½°N., Long. 96°E; Tavoy reported SSE/10 knots, Rangoon ENE/15 knots and Table Island NW/25 knots. By 0830 hrs. I.S.T. of 23rd it became deep and was centred near Lat. 15°N., Long. 95½°E; Rangoon reported ENE/19 knots and Table Island WNW/25 knots. Widespread and locally heavy rain had occurred on the Tenasserim coast and Deltaic Burma. At 1730 hrs. I.S.T. of 23rd the depression was centred off the Arakan coast near Lat. 17½°N., Long. 94°E. The depression then weakened and crossed the coast near Akyab on the 24th morning. Rangoon and Bassein each recorded 3″ of rain in the 24 hours ending at 0830 hrs. I.S.T. on 24th. The depression became unimportant soon after crossing the coast.

14. Cyclonic Storm in the Bay of Bengal—8th to 12th November.—The seasonal trough of low pressure over the southeast Bay and the adjoining east central Bay of Bengal became well-marked on the 5th morning. Port Blair reported SW/5 knots, Table Island SSE/25

knots. S.S. Jalaganga (Lat. 15°30'N., Long. 88°48'E) NE/13 knots and S.S. Aronda Lat. 11°18'N, Long. 85°12'E) NW/10 knots. The well-marked trough persisted for the next two days and concentrated into a depression on the 8th morning with centre near Lat. 14° N., Long. 88½°E; Table Island reported SSE/20 knots, S.S. Jalamayur (Lat. 13°6'N., Long. 85°24'E.), WNW/20 knots and S.S. Worcestershire (Lat. 9°48'N., Long. 89°48'E.) SW/20 knots with squalls. The depression was centred at 1730 hrs. I.S.T. of the same day near Lat. 15½°N., Long. 88½°E. and had deepened as the following observations would show:—

TABLE 8

Name of ship	Position		Time of obsns. I.S.T.	Wind		Remarks
	Lat. °N	Long.°E		Direction	Force	
S. S. Jalarashmi	10°24'	92°30'	1730	ESE	23 knots	
S. S. Khosrou	14 24	82 54	1730	WNW	20 knots	
S. S. Jalamayur	11 30	84 48	1730	W	30 knots	
S. S. Cleodara	12 00	86 00	1730	W	11 knots	Squally.

The depression gradually curved to northeast and intensified into a cyclonic storm by the early morning of the 9th. The following observations are significant in this connection.

TABLE 9

Name of ship or station	Position		Time of obsns. I.S.T.	Wind		Remarks
	Lat. °N	Long. °E		Direction	Force	
S. S. Jalarashmi	18°36'	90°42'	0530	ESE	44 knots	Continuous moderate rain.
Sandheads	..	..	0530	ENE	25 knots	
S. S. City of Calcutta . . .	17 54	86 06	0530	NNW	24 knots	

The cyclonic storm was centred at 0830 hrs. IST of that date near Lat. 18°N., Long. 89½°E. Widespread rain had fallen on the east Pakistan coast by the 9th morning. At 1730 hrs. IST of the 9th, the storm was centred near Lat. 18½°N., Long. 90°E; S.S. Jalarashmi (Lat. 18°54'N., Long. 90°42'E.) reported SSE/44 knots and Sandheads NE/20 knots. Thereafter the storm weakened and at 0830 hrs. IST of the 10th it lay as a deep depression centred near Lat. 19°N., Long. 90½°E. with a pressure defect of about 14 mbs at its centre. Pressures had by then commenced falling on the Chittagong coast and widespread rain had again fallen on the east Pakistan coast, Cox's Bazar recording 3" of rain and Chittagong 2" on the 10th morning. The depression weakened further as it approached the Chittagong coast and lay as a shallow depression centred at 0830 hrs. IST on the 11th near Lat. 21½°N., Long. 91°E. It crossed coast the same night and lay with its centre near Comilla on the 12th morning. Weakening further, it passed away northeastwards as a low pressure wave across upper Assam by the 13th morning. In association with it, fairly widespread or local rain fell in Assam between the 10th and 13th and scattered showers in Gangetic West Bengal between the 9th and 11th.

15. Severe cyclonic storm in the Bay of Bengal—26th November to 1st December.—A strengthening of Port Blair surface and upper winds on the 24th morning and a general fall of pressure over the southeast Bay of Bengal and south Andaman Sea, together with the following observations, gave indications that the seasonal trough was getting accentuated over the southeast Bay and the south Andaman Sea.

TABLE 10

Name of ship or station	Date	Time of obsn. I.S.T.	Position		Wind		Remarks
			Lat. °N.	Long.°E	Direction	Force	
S. Maloja	24-11-52	0530	13°00'	95°36'	SSE	18 kts.	
Port Blair	24-11-52	0830	..	..	E	18 kts.	Shower within last hour.
S. British Gratitude . . .	24-11-52	0530	12 24	90 18	ENE	10 kts.	Moderate rain.
S. Jalarashmi	24-11-52	0530	11 24	88 06	ENE	7 kts.	

By the 25th evening, another low pressure wave from the east moved into the Andaman Sea. Port Blair winds which were easterly 20 knots, at 2,000 ft. a.s.l. on the 25th morning, backed to northeasterly 20 knots by the same evening, and Mergui winds which were eastnortheasterly on that morning changed to light southeasterly up to 3,000 ft. a.s.l. by the evening. By 0830 hrs. I.S.T. of 26th, a depression formed with centre near Lat. 7°N., Long. 92°E; Car Nicobar reported easterly 15 knots, Nan Cowrie southeasterly 5 knots, S.S. Steel Chemist (Lat. 6°N., Long. 83°42'E.) northnorthwesterly 15 knots and S.S. City of Windsor (Lat. 9°24'N., Long.

82°54′E.) northnortheasterly 15 knots. On the 26th evening, S.S. Islami at Lat. 7°32′N., Long. 89°58′E. reported NNE wind of force 6/7 with rough sea. This would show that the depression had remained practically stationary and had deepened. The depression intensified rapidly into a severe cyclonic storm by midnight of t 26th centred near but slightly to the southeast of L 7½°N., Long. 90½°E. The following observations S.S. Islami are relevant in this connection.

TABLE 11

Date	Time I.S.T.	Position		Wind		Uncorrected bar reading	Air Temp.	Sea, Swell and weather observed
		Lat. °N	Long°E	Direction	Force B.F.			
							°F	
26-11-52 . . .	1920	7°34′	89°56′	N	6	29·80	79	Rough sea, moderate swell, overcast, lightn increasing in intensity.
		7°32′	89°58′	NNE	6/7	29·643(*)	79	Moderate swell from N, overcast, pass showers.
	2320	7°32′	90°32′	N	10	29·293(*)	79	Very rough sea, heavy swell from north, he rain, poor visibility.
		7°20′	90°32′	N	8/9	29·45	79	Vessel rolling heavily in rough sea and he swell from north. Overcast with heavy r
27-11-52 . . .	0020	...	...	NNW	7	29·263(*)	79	Sea rough, moderate to heavy swell fr NNW.
	0040	...	...	WNW	5	29·243(*)	80	Sea rough to moderate, moderate to he swell from W(confused), passing shower
	0120	...	...	WSW	5/7	29·263(*)	78	Sea rough, moderate to heavy swell fr west.
	0140	7°30′	90°45′	SSW	11	29·283(*)	78	Sea very rough, heavy swell from SSW, hea rain, poor visibility.
	0220	7°12′	91°	WSW	9/10	29·313(*)	78	
	0720	7°30′	91°20′	SSW	7	29·623(*)	81	Sea moderate, moderate swel, passing show
	1100	6°45′	92°23′	S	7	29·88	83	Rough sea and moderate swell, cloudy.

*The barometer readings in these cases are corrected values. The 2nd Officer of the ship informed that the barometer corrections in other cases would roughly —0·13″.

From the above observations it can be inferred that the ship S.S. Islami passed through the inner storm area ahead of the severe cyclone at 2320 hrs. I.S.T. of the 26th November and was near the centre, and in the region of relatively less strong winds during about the next two hours. The ship again got into the inner storm area in the rear by 0140 hrs. I.S.T. of the 27th and into the outer storm area later. It will also be seen that the lowest pressure recorded by the above ship was 990.3 mbs. (29:243″) at 0040 hrs. I.S.T. of the 27th.

The severe cyclone moved westnorthwestwards and was centred near Lat. 8°N, Long. 89°E on the 27th evening. It was centred near Lat. 8½° N, Long. 87½°E at 0530 hrs. IST on 28th S.S. Worcestershire at Lat. 8° 54′ N., Long. 87° 30′E reported NE/52 knots at 0415 hrs. IST and E/52 knots at 0630 hrs. IST of the 28th. Evidently the ship was within the inner core of t storm during this interval. At 0415 hrs. IST it record a pressure of 990·8 mbs. which is practically the sa as that recorded by S.S. Islami on the previous da This pressure was lower than that recorded by Port Bl (1009·7 mbs.) at 0830 hrs. I.S.T. on the 28th by mbs. and the storm had, therefore, at that time a pr sure defect of at least 22 mbs. at its centre. T vessel hove to between 0415 and 0630 hrs. I. S. and thereafter changed its course by 140° ap rently to move away from the storm centre. At 11 hrs. I.S.T. S.S. Worcestershire (Lat. 8°36′N., Long. 8 54′E.) reported a further veering of wind to SE/35 kn and a pressure of 998.5 mbs. The storm had apparen moved very little between 0530 and 1130 hrs. I. S. of 28th. Given below are the other significant ship reports received at 1130 hrs. I. S. T. :—

TABLE 12

Name of ship	Position		Wind	
	Lat. °N	Long. °E	Direction	Force(knots)
S. S. Jalausha	12°36′	84°12′	NNE	30
S. S. City of New York	11 42	83 42	N	24
S. S. Jalagopal	09 30	83 06	NNW	30
S. S. Orna	06 00	84 24	W	20
S. S. Celebes	05 48	84 54	W	28

By 1430 hrs. I.S.T., the wind experienced by S.S. Worcestershire (Lat. 8°26′N., Long. 87°57′E.) showed a further veering to south. At 1730 hrs. I.S.T. the s vere cyclone was centred near Lat. 8½°N., Long. 86½°E as the following ships' observations would indicate.

TABLE 13

Name of ship	Lat. °N	Long°E	Wind direction	Wind force
S. S. City of New York	10°06′	83°18′	N	35 knots
S.S. Jalagopal	08 30	83 54	NW	40 knots
S. S. Orna	05 42	84 42	W	6 B.F.
S. S. Worcestershire	08 00	87 54	S	25 knots

At about 0730 hrs. I.S.T. of the 29th, the storm was centred near Lat. 9°N., Long. 85°E., the following being the significant observations from ships.

TABLE 14

Name of ship	Position		Time of obsns	Wind	
	Lat.°N	Long.°E	I.S.T.	Direction	Force (knots)
S. S. Mathura	09°00′	82°12′	0800	NW	30
S. S. City of New York	07°06′	82°30′	0530	W	30
S. S. Jalagopal	07°20′	84°48′	0730	SW	Moderate to fresh gale.
S. S. Worcestershire	08°00′	85°54′	0730	SSW	25
S. S. Jalausha	13°24′	84°42′	0530	NE	25

S.S. Jalagopal, which left Nagapattinam for Penang on the early morning of the 28th with 1,600 passengers on board, experienced very severe weather in the southwest quadrant of the cyclone on the night of the 28th-29th. She was about 200 miles to the west of the cyclone centre on the 28th evening and about 150 miles to the south on the early morning of the 29th. At 1016 G.M.T. (1546 I.S.T.) on the 28th, the ship which had changed to a southeasterly course reported at Lat. 8°53′N., Long. 83°39′E., northwest wind, speed 36 knots gusting to 45 knots frequently, with continuous heavy rain and visibilty half a mile. Barometric pressure was falling steadily, the fall in the previous 3 hours being 3·4 mbs. There was a northwesterly swell with period of waves 12 to 13 seconds and height of waves 15′ to 20′. On the 29th morning (00 G.M.T.) when the ship was at Lat. 7°20′N., Long. 84°48′E., on a south-south-east course, she reported wind W by N., 50 knots, gusting to hurricane force all night, with continuous heavy rain, visibility nil, heavy sea with west-northwesterly heavy swell and mean height of waves 25′ to 30′. [N.B.—As discussed in subsequent paras, the diameter of the core of the hurricane winds was limited to about 80 miles including the eye. With the position of the ship as given, the ship would be about 120 miles away from the storm centre where one would expect the winds to have moderated considerably. The position of the ship thus appears to be rather out, being apparently based on dead reckoning.] Barometric pressure was 1006·8 mbs. and had been falling steadily in the previous 3 hours. The ship was labouring heavily with a maximum roll of 33°. The Captain stated that extremely rough weather with mountainous seas was experienced on the night of the 28th-29th from 9 P.M. to 6 A.M. as the ship was sailing on a south-southeast course to avoid the cyclone. The ship had a miraculous escape with only a slight damage.

At 1730 hrs. I.S.T. of the 29th, the storm was centred near Lat. 10°N., Long. 83°E., as the following observations would indicate. No observations were, however, available from within 200 miles of the storm centre.

TABLE 15

Name of ship or Station	Position		Wind
S. S. Bharatmata	Lat. 13°12′N	Long.81°48′E	NE/30 knots.
Jaffna (Ceylon)	..	..	NW/15 knots
Trincomalee (Ceylon)	..	..	W/20 knots.

By 2330 hrs. I.S.T. on the 29th, the storm was centred near Lat. 10°N., Long. 82°E. Trincomalee reported westerly 25 knots, Cuddalore northnortheasterly 15 knots and S.S. Jalakrishna (Lat. 11°45′N., Long. 80° 49′E.) northeasterly 20 knots. At 0530 hrs. I.S.T. of the next day, it was centred near Lat. 10°N., Long. 81½°E; S.S. Bharatmata (Lat. 13°18′N., Long. 82°24′E.) reported ENE/E 40 knots. S.S. Jalakrishna (Lat. 11° 17′N., Long. 80°51′E.) NE/30 knots and Trincomalee WSW/20knots. At 0930 hrs. I.S.T. S.S. Clan Mactavish at Lat 11°16′N., Long 80°54′E., reported easterly wind of Beaufort Force 11, high seas and heavy swell. The ship was apparently within the inner core and the storm centre was then near Lat. 10½°N., Long. 80½°E A copy of the report about weather experienced by S.S. Clan Mactavish on the 30th as received from the ship is given below :—

"November 29th :— Sailed from Madras at 1800 hours I.S.T. for Colombo. Weather report received giving centre of severe cyclonic storm at Lat. 11°N., Long. 83°E and likely to move west or northwest. Set course of 162 degrees from Madras, 16 kts.

Whether at Midnight (29th) : wind NNE Force 7 Barom. 1004·3 falling 3·7 mbs. in previous four hours. Temp. 78 degs. Heavy NE'ly sea and very rough N'ly sea.

At 0200 hrs. (30th) vessel hove to in high confused sea and swell and brought round to steer 030. D.R. Position: Lat. 11°15′N., Long. 80°56′E. Wind NNE force 8. Barom. 997·6 mbs. (a drop of 6·7 mbs. in previous two hours) and still falling.

At 0800 hrs. with wind NE/E force 12, the barometer was 992·0 mbs. and had reached its lowest reading. The centre of the cyclone was at this time estimated to be from 10 to 20 miles away and moving due west. The vessel was now labouring very heavily in precipitous seas and a very heavy confused swell. Visibility was reduced to 600 yds. At this time the wind was estimated to be 70 m.p.h. increasing to 90 m.p.h. in squalls.

At 0900 hrs. the wind had veered to ENE and was still force 12. Barometer was reading 992·8. Sea and swell still higher and more confused.

By noon the barometer had risen to 999·5 and was still rising. The wind had veered steadily to SE and was now force 10-11. A high southeasterly sea and very heavy swell persisted and visibility was 1,000 yards.

At 1600 hrs. the barometer was reading 1004·0 and still rising. The sea and swell had gone down a lot but still heavy. Visibility 5 miles.

From 0700 hrs. until noon, the wind veered rapidly from NE to SE and during this time the ship was headed into the wind and moved round the northern semi-circle of the cyclone. The wind was estimated to be at its strongest at about 0900, one hour after passing the centre of the cyclone. The weather during the following eight hours improved steadily. The visibility was 10 miles, slightly reduced in the occasional rain squalls which were experienced. The wind continued to be moderate and was force 5 at midnight (30th). The barometer rose a further 6·0 mbs. and the sea and swell became moderate. The sky remained overcast."

It will be seen from the above report that the lowest pressure recorded by S.S. Clan Mactavish was 992·0 mbs. at 0800 hrs. I.S.T. of 30th which was 1·7 mbs. higher than that recorded by S.S. Islami at 0040 hrs. I.S.T. of the 27th, it being presumably not so near the centre, or in the central region of less strong winds, as the latter ship. Given below is also an account by another ship S.S. Jalakrishna. This ship recorded a pressure of 985·7 mbs. at 1030 hrs. I.S.T. of the 30th, this being the lowest observed over the sea during the history of this storm. In spite of the lowest pressure recorded by this ship, it would appear that it did not pass through the centre or the central region of the less strong winds, the wind being of force 12 even at the time of the lowest pressure. It would also appear that between midnight of 26th-27th night when S.S. Islami was near the centre and morning of the 30th when S.S. Jalakrishna was in the inner storm area, the cyclone had deepened considerably with reference to pressure deficiency at its centre, it being more than 30 mbs. on the 30th morning.

Account by S. S. Jalakrishna :—"As we lay at our moorings in Madras harbour, the day of 28th November 1952 closed with a light northeasterly wind, fine and clear, and our first suspicion that a cyclonic storm had formed in the Bay came at 0030 hrs. on 29th, when the vessel commenced to surge to a heavy swell which was entering the harbour. Shortly afterwards the wind from NNE force 2 began to increase with gusts of about force 4, still, however, remaining from the same direction. At day light the most obvious sign appeared, a large, dark threatening mass of cloud in the southeastern part of the sky which gradually spread as the day advanced, until, at 1600 hrs. it covered the entire sky. The barometer, however, remained steady at approximately 1011·7 mbs. until 1300 hrs. after which it commenced to fall slowly.

When we left the harbour at 1500 hrs. the wind had increased to force 6, NNE, and this, combined with a heavy easterly swell, made steaming in any direction to windward in the conventional manner an impossibility at our relatively light craft. I, therefore, adopted a southeasterly course with the sole object of taking the vessel a safe distance off the land as rapidly as possible. That this would take us athwart the path of the approaching cyclone I was well aware, but it was our only choice and we accordingly prepared the vessel to meet the worst possible weather.

The barometer was now falling slowly and the wind and sea continued to increase. At 1600 hrs. the sky became completely overcast and about 1700 hrs. we experienced the first of a series of rain squalls which became more frequent as time went on. By 0200 hrs. on 30th the wind had increased to force 8 and had veered one point to NE/N. We were then in Lat. 11°29′N., Long. 80°52′E—about 60 miles from the nearest land and as the vessel had commenced to roll very violently to a heavy easterly swell, I decided to heave to.

The barometer continued to fall slowly but at an increasing rate until 0700 hrs. on 30th, after which it fell rapidly until the lowest reading of 985·7 mbs. was recorded at 1030 hrs. The wind was then ENE force 12, and we assumed by the confused nature of the sea that the storm centre was passing close to the south. The barometer then rose rapidly until 1800 hrs. after which it rose much more slowly, finally, returning to normal at 0600 hrs. on 1st December.

Throughout the night the weather continued to deteriorate and the worst part of the storm was experienced between 0800 hrs. and 1430 hrs. on 30th. During this period the wind veered from NE to E × S; shifting three points between 1000 hrs. and 1200 hrs. and blew with hurricane force. Frequent squalls of terriffic fury were accompanied by torrential rain which, combined with the flying spray blown from the wave crests, limited visibility to about 2 cables. The sea became more and more confused, resembling great pyramids of water with breaking, overhanging crests which were blown forward by the wind and often struck the ship with great force, sending showers of heavy spray over the entire superstructure. Measured from our elevation on the bridge the waves must have been about 40 ft. in height, but, due to the fact that we were only about one quarter loaded, only occasional heavy seas succeeded in breaking on board, and what little damage we sustained was due mainly to the wind.

About 1500 hrs. the squalls became less frequent and less severe, and by 1600 hrs. the wind had dropped to force 10. From then on the weather improved rapidly. At 2000 hrs. the wind had decreased to force 5, with a moderate sea and swell and by 2200 hrs. the sky had cleared, though occasional showers persisted until 0200 hrs. on the morning of 1st December."

The severe cyclone struck the coast at Lat. 10° 30′N., about 10 miles to the north of Point Calimere and about 20 miles to the south of Nagapattinam on the afternoon of the 30th at about 1-30 p.m. Nagapattinam recorded a pressure of 970 mbs. at the time of crossing. This was the lowest recorded pressure in the history of this storm. At 11-30 hrs. I.S.T. S.S. Clan Mactavish (Lat. 10°58′N., Long. 81°02′E.) reported southsoutheasterly 45 knots and S.S. Jalakrishna (Lat. 11°36′N., Long. 80°41′E.) easterly 30 knots. The cyclone moved at an average speed of about 10 m.p.h. upto the morning of the 30th and at a somewhat increased speed (about 12 m.p.h.) later. The storm moved rapidly westwards and was centred at 1730 hrs. I.S.T. near Tanjore about 50 miles to the west of Nagapattinam. Tiruchi was then having a wind of northwesterly 44 knots and pressure 994·0 mbs. Nagapattinam was then experiencing southsoutheasterly wind 40 knots. The storm, however weakened rapidly during the following night and emerging into the Arabian Sea, lay as a low pressure area in the southeast Arabian Sea on the morning of 1st December.

At the time of the cyclone crossing the coast, the coast line was invaded by a storm wave of great force and of height of about 4 ft. according to the estimates

of the Port Officer, Nagapatinam and the French Administrator at Karaikal. Fortunately it was low tide time over the coast where the storm wave advanced. Otherwise heavier damages and loss of life would have occurred over the coastal area as a result of the storm wave. The sea water drained off into the sea between 4 and 6 p.m. A second storm wave was, however, observed over the coastal strip west of Point Calimere which runs practically east-west. After the passage of the storm inland, the northwesterly hurricanes which prevailed over this coast before the storm struck, were rapidly replaced by southerly hurricanes in the rear of the storm centre and, these being just normal to the coast line, gave rise to a second storm wave which advanced in a south to north direction over distances varying from 2 to 7 miles inland. This storm wave is reported to have completely washed away the railway line and damaged the railway bridge between Agasthiampalli and Point Calimere.

On the forenoon of the 30th *i.e.*, before the storm crossed the coast, an instance of the recession of the sea was reported by fishermen of the village Kattumavadi in Arantangi Taluq in Tanjore district. Strong west to northwesterly gales were blowing over the region at that time. The returning fishermen were beginning to put their boats ashore when they noticed that the fishing boats were rapidly moving seaward as a result of the recession of the sea. They reported that the boats had drifted nearly 2 miles away from the shore. Jumping into the water, they noticed that water was just knee deep at a place where the normal depth used to be 12 ft.

The weather diary of Nagapattinam for the 30th, reproduced below, gives a vivid description of the severity of the storm :—

"The sky was overcast with F St. clouds with continuous drizzle and rain throughout the day. At 1030 hrs. the force of the wind was 44 m.p.h. from NW and it intensified gradually between 1230 and 1630 hrs. having a force of 80-100 miles approximately. The direction also moved gradually from N to SSE. During that time the storm was at its climax. At 1110 hrs. the anemometer went out of order. Recording of rainfall was impossible after 1130 hrs. as the raingauge was flooded with sea water and also due to spraying. After 1730 hrs. the force of the wind began to subside and at 2030 hrs. it was about 10-16 miles. The sky also cleared afterwards gradually."

It is interesting to note that although the lowest pressure was recorded at 13 hrs. I.S.T., the hurricane wind continued up to 1630 hrs. IST.

The weather diary for the 30th of Tiruchirapalli about 80 miles to the West of Nagapattinam, is also interesting in this connection and is reproduced below:—

"Sky overcast from the early morning with As and St intermittent drizzles, surface wind NW/7-10 knots till noon. In the afternoon from 14 hrs. wind speed attained gale force. Light continuous rain from forenoon. Thick Ns and St till 1600 hrs. giving continuous moderate rain. By 1800 hrs. wind force increased uprooting trees blowing off sheds and tiled roofs, twisting and displacing electric posts. A cyclonic storm approached the station from northeast. At 1930 hrs. I.S.T. wind speed shot upto 80-90 m.p.h. causing considerable damage to the station. Gradually the wind veered to E and then to S By 2400 hrs. wind began to decrease and gradually rain also became light intermittent; still at 24 hrs. violent gusts of wind were blowing."

It is further interesting to note that the wind at Tiruchirapalli began to shoot up at about 1800 hrs. I.S.T. *i.e.*, about 5½ hours after the wind began to shoot up at Nagapattinam and about 5 hours after the storm centre crossed the coast.

That the storm was of small core is proved by the fact that the port of Cuddalore situated only about 60 miles north of Nagapattinam recorded a maximum wind speed of 20-30 knots, reaching 30 to 40 knots in gusts. The weather diary of Cuddalore for the 30th is also reproduced below as of interest:

"Early morning wind speed rose from 5 to 15 knots. Previous day's gloomy weather continued throughout the day. Sky remained completely overcast with As, Ns, Sc and clouds of bad weather. From 1000 hrs. strong wind 20-30 knots, in gusts 30 to 40 knots. Continuous rain and drizzle with occasional strong showers followed in late evening. Recorded 2·85″ of rain. Steady strong gale speed wind prevailed throughout the day and night till 2130 hrs. Direction NE to E."

Barogram of Nagapattinam.—(*Accounts given under this sub-heading as well as under the two following sub-headings have been taken from the article "The severe Nagapattinam cyclone of 30th November 1952", by P. R. Krishna Rao and S. N. Sen in Current Science, April,1953.)

The barogram of Nagapattinam observatory reproduced in Fig. 1 reveals some very interesting features about the cyclone. The lowest pressure reached was about 970 mb. at about 1-30 p.m. on the 30th. This was about 40 mb. below the pressure 24 hours earlier which was about the normal pressure. The pressure began falling rapidly from 10 a.m. and fell by 29 mbs. from 999 to 970 mbs. in about 3 hours' time. The most rapid fall of pressure was 14 mbs. from 1130 a.m. to 1240 p.m. a period of 1 hour and 10 mts. which works out to a rate of fall of 12 mbs. per hour. With the estimated speed of movement of cyclone, *viz.*, 12 m.p.h. the steepest pressure gradient in the inner area of the cyclone, as it passed Nagapattinam, works out to 1 mb. per mile. This was at a distance of about 20 miles from the centre. The gradient of 1 mb. per mile agrees with average pressure gradient in typhoons with minimum pressure of 960 to 973 mbs. given by Deppermann [Deppermann C.G., "Some characteristics of Phillippine Typhoons" (1939) Manila—referred to on p. 88 of Comp. of Met. 1952]. The steepest rate of pressure fall on record at the centre of an Indian cyclone was 25 mbs. per hour in the False Point cyclone (Eliot, Sir John, Cyclone Memoirs, No.V 1893,81) of 5th November 1891 which had the lowest pressure of 949 mbs. With a speed of movement of 10 m.p.h. the steepest pressure gradient in that cyclone works out to 2.5 mbs. per mile, while in the present Nagapattinam cyclone it is estimated to be 1 mb. per mile at a distance of 20 miles from the centre and about 10 miles from the periphery of the "Eye".

If one assumes that the pressure gradient from Nagapattinam to the centre where the cyclone struck coast at a distance of about 20 miles to its south, was of the order of 1 mb. per mile if not more, the pressure at the centre would be at least 950 mbs; actually it might be much less. It may be mentioned that a lowest barometric pressure of 919 mbs. (27·135″) was recorded at the False Point Light-house in an earlier storm on 22nd September 1885.

Another interesting feature shown by the Nagapattinam barogram is the rapid fluctuation of pressure at the time of minimum pressure, exhibiting pronounced "pumping" over the central region of the cyclone. The maximum amplitude of the fluctuations was as large as 7 mbs. the pressure fluctuating between 970 and 977 mbs.

The eye of the cyclone.—The Nagapattinam cyclone had a pronounced "eye" or calm centre, as should be expected in a cyclone with such steep pressure gradient.

The following information obtained later on from the 2nd Officer of S.S. Islami, is relevant in this connection.

"While passing through the storm, the ship experienced very bad weather. Sky was overcast with low nimbus clouds and heavily raining. The sea was rough and swell very heavy. The wind was very strong. When the ship was almost in the centre of the storm, *patches of clouds with openings* were observed, wind was moderate. When the ship passed out of the centre the wind direction changed and force increased considerably, blowing off the ladder of the ship."

In this connection a summary of weather at Point Calimere reported by the Keeper-in-charge of the Light House there, is also given below.

"On the whole day of the 29th November, the sky was almost clear with some passing clouds. There was no rain. The wind direction was northeast. Towards midnight the sky began to overcast with heavy clouds and very chilly NW wind. This continued until 7 a.m. of 30th with intermittent drizzling. After that the force of the wind and rainfall increased gradually. At 9 a.m. the wind from the same direction increased to gale force mingled with moderate rain. This lasted up to 1 p.m. After that, the wind and rain suddenly stopped; sky began to clear with bright sunshine. The air was dead calm. Suddenly at about 1-45 p.m. some rumbling noise resembling distant approaching train was heard from south with whitish high waves in the sea. At 1-45 p.m. the wind at a force of about 75 to 80 miles an hour struck the coast from the south. The trees and roofs of the building began to fall down on the first impact itself. This lasted up to 4 p.m. and then onwards the force of wind decreased gradually. During the period of the cyclone there was very little rain in our part and should, in my estimate, be under 2" on the whole."

Mr. S. Gasper of the Regional Meteorological Centre, Madras, who visited the cyclone-affected areas, gathered information of similar experience of "Calm" condition at Tiruthuraipundi, about 20 miles to the southsouthwest of Nagapattinam and 22 miles to the northwest of Point Calimere, and also at Vedaranyam, about 6 miles to the north of Point Calimere. The Tahsildar at Tiruthuraipundi had recorded that heavy rains and northerly gales commenced at 0900 hrs. I.S.T. on the 30th and continued uninterrupted till 1415 hours. Thereafter, there was sudden cessation of rain and wind but the sky remained overcast. After about an hour of calm condition, hurricane winds recommenced from the opposite direction with heavy rain. At Vedaranyam, the Deputy Tahsildar had recorded similar observation with the difference that the lull in weather commenced at 1300 hrs. and lasted for about 45 minutes.

The calm condition commenced at about 1300 hrs. I.S.T. at Point Calimere and Vedaranyam, and at about 1415 hrs. I.S.T. at Tiruthuraipundi. Considering that the cyclone moved due west across the coast and that Tiruthuraipundi is about 15 miles due west of the coast, the approximate speed of movement of the cyclone works out to be 12 m.p.h. agreeing with the speed estimated from the positions of the cyclone centre as located on the synoptic weather charts. As the duration of the calm over Point Calimere was about 45 minutes, it means that a chord of about 9 miles of the "Eye" passed over that station. Similarly, a 12-mile chord passed over Tiruthuraipundi. On this basis the position of the "Eye" at the time of the cyclone centre crossing the coast is indicated in Fig. 2. Assuming the eye to be circular, its diameter works out to be about 20 miles. Even though the average diameter of the "Eye" of tropical cyclones is believed to be 10-15 miles, "Eyes" having diameters of 20-30 miles have also been observed in intense storms. A diameter of 40 miles has been reported (Simpson R. H., Bulletin American Met. Society 1952, 33 No. 7, 286) from actual aircraft exploration of the "Eye" of a severe typhoon in the China Seas in August 1951 with a central pressure of 895 mb. A severe cyclone at the head of the Bay of Bengal on the 27th May 1936 had an "Eye" of about 20 miles diameter with a central pressure of 979 mbs. The estimated diameter of the "Eye" of the recent Nagapattinam cyclone is, therefore, consistent with its severity as indicated by the steep pressure gradient and a central pressure of 970 mbs. It is interesting to note that the "Eye" of the cyclone became obliterated within a short distance after crossing the coast as it was not felt at Pattukottai, about 35 miles west of the point where the centre crossed the coast. The cyclone passed about 25 miles south of Tiruchirapalli. The microbarogram of Tiruchirapalli showed a fall of pressure of 18 mbs. between 10-30 a.m. and 7-30 p.m. the fall being steepest between 5-30 p.m. and 7-30 p.m. The lowest pressure recorded at Tiruchirapalli was 979 mbs. at 7-30 p.m.

Winds in the cyclone:—As already stated, the cyclone was a very severe and concentrated one with a comparatively small core of hurricane winds around the calm centre ("Eye"). Nagapattinam had hurricane winds for about 5½ hrs. from 11 a.m. to 4-30 p.m. Assuming that the core of hurricane winds was circular and the speed of movement of the cyclone was 12 m.p.h. when it struck the coast, a chord 66 miles ($12 \times 5\frac{1}{2}$) long of the inner core must have passed through Nagapattinam. From this it is estimated that the radius of the core of hurricane wind was about 38 miles. As the radius of the "Eye" was about ten miles the annulas of hurricane winds around the "Eye" was about 30 miles wide. The diameter of the core of hurricane winds including the "Eye" was, therefore, about 80 miles. The extent of the core is also shown in Fig. 2.

The highest wind speed reached in the cyclone can only be estimated indirectly as there was no instrumental record. From the severe nature of the damage caused *viz.*, bending of telegraph poles, uprooting of big trees, snapping of the trunks of trees of 4′ to 5′ diameters, shaking and collapses of strong buildings and roofs etc. it has been estimated by some that wind speed may have reached 150 m.p.h. in gusts, while the lowest estimate is 80 to 90 m.p.h. From the very steep pressure gradient and the magnitude of the pumping of the barometric pressure at Nagapattinam as indicated by the barogram, it would appear that the wind must have reached a speed of over 100 m.p.h. and 150 m.p.h. in

gusts may not be an overestimate. In the Masulipatam cyclone of October 1949 (Sen S. N. and George C. A.—Indian Journal of Meteorology and Geophysics, 1952, 3 No. 4, 264) in which the central pressure was 997 mbs. and the pressure gradient in the core of hurricane winds as estimated from Masulipatam bárogram was only 1 mb. in 51 miles, an estimated wind speed of about 100 m.p.h. was reached. It should be remarked that the area of hurricane winds need not necessarily be circular. In fact, it is known (Dunn, G. E., Compendium of Meteorology, 1952, 889) that in westward-moving tropical cyclones in the northern hemisphere, gales and hurricanes extend further to the north than to the south, which appears to have been the case in the Nagapattinam cyclone. The area of gales extended upto Madras, about 200 miles to the north of the centre. Towards the south, however, gales were experienced at Jaffna about 80 miles to the south of the cyclone centre, but not at Pamban, about 120 miles to the southsouthwest. Tiruchirapalli, situated about 80 miles to the west of Nagapattinam, experienced gales after 3 p.m. and the strongest winds, about 50 to 60 m.p.h., were experienced at 7 p.m. to 8 p.m.

Under the influence of this storm, widespread rain occurred in Tamilnad on 1st and 2nd December with locally heavy to very heavy falls on the 1st. Local or fairly widespread rain also occurred in Rayalaseema, Malabar-South Kanara, Mysore and Travancore-Cochin on these two days. The damages caused by the cyclone were mainly of two types, (1) those due to the hurricanes and (2) those due to the storm wave. Damages due to heavy rain and floods were small compared to the above. The hurricanes ravaged practically the whole of Tanjore district, the Taluqs of Tiruchi, Alangudi, Tirumayam, Kelathur and Kulitalai in Tiruchi district and to a lesser extent the Taluqs of Udayarpalayam, Lalgudi and Karur in the same district and left South Arcot district practically unaffected. According to information collected informally from the various local officials, over 400 human lives were lost and 30,000 cattle perished; 2,18,000 houses (including huts) and buildings were damaged; about 22,000 acres of fertile paddy fields were damaged by saline action, the loss of yield in paddy from the standing crops alone amounting to Rs. 71 lakhs. Damages suffered by plantain gardens and betel vines amounted to Rs. 1 crore 4 lakhs and 18 lakhs respectively. Number of trees uprooted were about 18 lakhs and were as high as 40 to 60 per cent of the number of trees that existed before the storm, in some of the worst affected areas. Total losses of all kinds in terms of cash value exceeded 6 crores of rupees.

A statement giving district averages and noteworthy amounts of rainfall is given below—

TABLE 16

State and district	District average on 30th Nov.	1st Dec.	2nd Dec.	Particularly heavy falls
Madras				
Madras	..	3·7	..	
Chingleput	..	3·3	..	On 1st Red Hills 6·3″, Tamarapauck 6.4″, Kesararam 6·8″, Korattur 5·2″, Tiruvallur 5·4″, Tirupathi 7.0″.
				On 2nd Sriperumbudur 5·3″.
Chittoor	..	..	..	On 1st Chembarambakkam 5.6″ Kalahasti, 6.5″.
Madras—contd.				
North Arcot	..	2·3	..	On 1st—Poiney Anicut 5·7″.
South Arcot	..	2·7	..	On 1st—Tirukkoyilur 0·5″.
Tanjore	..	3·5	..	On 1st—Pattukkottai 6·0″. Adirampatnam 5·8″, Ichanviduthi 5·7″, Madukkur 6·3″.
Tiruchirapalli	..	2·7	..	On 30th—Illuppur 6·5″, on 1st Manapparai 5·7″, Marungapuri 6·4″, Uppiliyapuram 5·6″.
Pudukkottai Division.	..	5·8	..	On 1st—Adamakkottai 8·6″, Alangudi 15·0″, Karaiyur 7·0″, Malaiur 7·0″, Porungalur 7.4″, Pudukkottai 7·5″.
The Nilgiris	..	2·5	2·3	On 1st—Coonoor 5·3″, Kodanad 5·4″, on 2nd Kethy 7·2″, Coonoor 9·0″.

16. Shallow depression in the south Arabian Sea—1st to 5th December.—The well-marked trough of low pressure which lay in the southeast Arabian Sea on the morning of 1st December, after the weakening of the Nagapattinam cyclone described above, concentrated into a shallow depression by the same afternoon with centre near Lat. 11°N., Long. 73½°E. The shallow depression moved in a westerly direction and lay centred near Lat. 11½°N., Long. 70½°E., at 1130 hrs. I.S.T. of the 2nd. Minicoy winds which had been W/NW backed to S by the morning of 2nd; S.S. Lombok at Lat. 12°30′N., Long. 67°E. reported northerly wind of 18 knots and S.S. Glaucus at Lat. 9°6′N., Long. 67°42′ E., reported rain and northwesterly wind (speed 16 knots) at 1130 hrs. I.S.T. of 2nd. Continuing to move westwards, the shallow depression was centred at 1130 hrs. I.S.T.of the 4th near Lat. 11½°N., Long. 61′E. S.S. British General at Lat. 11°N. Long. 61°36′E., reported a southerly wind of 30 knots at that hour. Thereafter it weakened into a trough which moved away westwards.

17. Shallow depression in the Bay of Bengal—6th-7th December.—Under the influence of a low pressure wave from the east, the seasonal trough in the southeast Bay of Bengal became well-marked by the 5th morning. Moving westwards, it concentrated into a shallow depression centred near Jaffna by the 6th evening. The shallow depression moved northwestwards and crossing the south Coromandel coast, lay between Tiruchi and Nagapattinam on the morning of 7th. It thereafter weakened and emerging into the east Arabian sea by the next morning, lay as a trough of low pressure off the Malabar and South Kanara coast. The trough moved slightly westwards and became unimportant by the 10th.

In association with the above depression fairly widespread rain occurred over the south Peninsula between the 7th and 10th. Locally very heavy rain occurred along and near coastal Tamilnad on the 7th morning, state raingauge stations at Villupuram and Tanjore in Tamilnad reporting 11″ and 9″ of rain respectively. Cuddalore also reported 5″ and Nagapattinam 4″ on that day. Locally heavy to very heavy rain also occurred in and near south coastal Andhradesa on the 8th.

II. ACCOUNT OF WESTERN DISTURBANCES DURING 1952

Most of the western disturbances during the months of January, October, November and December were feeble and caused only scattered or local precipitation in the extreme north of the country. On the other hand, some of the western disturbances during February and March were active and in association with their secondaries caused fairly widespread thunderstorm-rain over the northern and central parts of the country. Some of the thunderstorms in February were also severe and accompanied by hail. The secondaries of the disturbances during March were responsible for local duststorms over the Punjab (I) and Uttar Pradesh. The disturbances during the period April to June caused very little precipitation over the plains; but their secondaries caused severe duststorms at many places in northwest India. A few western disturbances during July and September caused an increased inflow of monsoon air into the Punjab (I) and adjoining areas and gave good rainfall there. A list of the 52 western disturbances that affected the country, classified according to the nature of the precipitation caused by them, is given in the following table. Description of the more active ones are added.

TABLE 17

Nature of precipitation	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Widespread	2	3	4	..	1	..	..	..	..	..	..	2
Local	1	1	2	1	2	..	..	..	1	..	..	..
Little or none.	4	2	..	4	3	5	2	..	3	2	3	4
No. of disturbances each month	7	6	6	5	6	5	2	..	4	2	3	6

1. Western disturbance of the period 27th February to 3rd March.—A western disturbance appeared over Baluchistan on the 27th February and moved away eastwards across the extreme north of the country causing a few showers in Jammu-Kashmir. A secondary low formed over west Rajasthan and adjoining parts of Sind on the 28th and moved in an easterly direction upto Madhya Pradesh. There was a pronounced incursion of moist air from the Bay of Bengal into the field of the low pressure area and as a result, fairly widespread thundershowers occurred in Uttar Pradesh on the 1st and 2nd March and in the plains of the Punjab (I) and in Vindhya Pradesh on the 2nd. Locally heavy rain accompanied by thunder and hail was reported from the Punjab (I) on the 2nd March, Delhi and Dharamsala recording 2″ each. Delhi experienced a severe thunderstorm accompanied by hail on the afternoon of 1st. According to press reports the hailstorm caused dislocation of electric supply and telegraph service in the city, besides causing considerable hardship to the population. With the further eastnortheastward movement of the low through northeast India the rain belt shifted to the east and widespread rain or thundershowers occurred in east Uttar Pradesh, east Madhya Pradesh, and northeast India on the 3rd. Local or fairly widespread thundershowers continued in Assam and Sub-Himalayan West Bengal on the 4th and 5th.

2. Western disturbance of the period 12th to 17th March.—A western disturbance was observed over north Baluchistan and the Northwest Frontier Province on the 12th March. On the 14th morning, it was noticed to be moving into the Punjabs, while a secondary developed over west Rajasthan and adjoining Sind. On the next day, the western disturbance moved away across Jammu-Kashmir, while the secondary was over east Rajasthan, north Madhya Bharat and adjoining parts of Vindhya Pradesh and Uttar Pradesh. The latter moved slowly eastwards in the course of the next 3 days and was responsible for a pronounced incursion of moist air into the central and northern parts of the country. Fairly widespread thundershowers occurred in the Kumaon hills, the Punjab (I) and Vindhya Pradesh on the 15th, along a belt extending from the Punjab (I) to west Assam on the 16th, and in northeast India on the 17th.

Another secondary trough of low pressure appeared over north Rajasthan and the adjoining Punjabs on the 16th and moved away northeastwards next day. As a result of this, the thunderstorm activity in the Punjab (I) and northwest Uttar Pradesh continued on the 16th and 17th also.

Locally heavy rain occurred in the Punjab (I) on the 16th, the principal amounts of rainfall being—Dharamsala 3″, Dharampur 2″ Dalhousie, Simla, Pathankot, Ambala, Ludhiana, Mussoorie, Dehra Dun and Roorkee 1½″ each. Widespread and locally heavy snowfall also occurred in Jammu-Kashmir, and the Punjab-Kumaon hills on the 15th and 16th. According to press reports the rains in the Uttar Pradesh were untimely and caused considerable hardship to the farmers. Due to heavy snowfall over the hilly areas of the Punjab (I) and Uttar Pradesh damage to crops and plantations in some of the districts was also reported. At Bibiwala near Rishikesh, 6 persons were reported to have died of lightning stroke during a hailstorm on the 16th.

3. Western disturbance during the period 21st to 25th March.—A western disturbance which was over north Baluchistan and adjoining Sind on the 20th March, moved eastwards and lay over northwest Rajasthan and adoining Punjab (P) on 21st morning. It induced a secondary low over east Rajasthan and neighbourhood on the 21st afternoon. On the 22nd morning, the primary western disturbance was lying over the northern parts of the Punjabs, while the secondary was over southwest Uttar Pradesh and the adjoining parts of Rajasthan and Madhya Bharat. By this time a moist current of air from the Bay of Bengal was being drawn into the central and the northern parts of the country. Thunderstorm rain was fairly widespread in the Punjab-Kumaon hills and occurred locally in the plains of the Punjab (I) on the 22nd. Scattered duststorms also occurred in Rajasthan and the plains of the Punjab (I) on this day. On the 23rd morning the primary disturbance was moving away eastwards across the Punjab hills, while the secondary lay over southeast Uttar Pradesh and adjoining parts of Vindhya Pradesh and Chota Nagpur. The secondary moved in an easterly direction and passed away across Assam on the 25th. Fairly widespread thundershowers occurred successively in east Uttar Pradesh, Chota Nagpur, West Bengal and Assam between the 23rd and the 26th. A few of the thundershowers in Uttar Pradesh were accompanied by hail.

Of the local storms reported in newspapers, the following are noteworthy:—

Place	Date and time	Classification of storm	Loss of human life	Remarks
Nagpur	8th February—Night.	Thunderstorm	...	Wind speed during squall reached 56 m.p.h. Telegraph and telephone communications and electric supply were interrupted.
Hoshangabad	8th February—Afternoon.	Severe hailstorm	...	Hailstones of the size of small oranges were reported to have fallen. Several trees were uprooted and heavy damage was caused to mango, wheat and other crops.
Umrer	9th February	Severe hailstorm	...	Many huts were blown off. 12 bullocks were killed. Considerable damage to crops was also reported.
Moga	21st February	Hailstorm	...	The hailstorm was followed by a heavy thundershower. Some damage to crops was reported.
Gwalior	1st March—Evening.	Hailstorm	...	Damage to crops was estimated at Rs. 26 lakhs and about 2 lakhs tons of foodgrains were reported to have been lost. Telegraph traffic was dislocated and electricity supply in Gwalior broke down. It was reported that the streets had a snow-white appearance due to hail. Heavy showers accompanied the hailstorm.
New Delhi	1st March—Afternoon	Thunderstorm	...	The thunderstorm was accompanied by three spells of hailstorm when hailstones of the size of table tennis balls were reported to have fallen. Wind speed reached 42 m.p.h. during squall. Temperature fell by nearly 20°F during the storm. Transport arrangements and electricity supply broke down and low lying areas in the city were flooded. Considerable damage to standing crops was also reported.
Raipur	2nd March	Hailstorm	...	Considerable damage to crops was reported. Several buildings were damaged, the loss being estimated at Rs. 20,000. Two persons were seriously injured by tin sheets blown off roofs of buildings.
Cooch Behar	10th March	Thunderstorm	1	Roofs were blown off several buildings, many trees were uprooted and telephone lines snapped at several places. One person was electrocuted by a snapped electric wire.
Nagpur	13th March—Evening.	Thunderstorm	...	The thunderstorm was accompanied by hail, wind speed during squall reached 48 m.p.h.
Runnisaidpur (Muzaffarpur dist.)	16th March	Hailstorm	...	Heavy damage to standing crops was reported.
Calcutta	16th March—Afternoon.	Nor'wester.	...	Wind speed in squall reached 34 m.p.h. Temperature dropped by 6°F during the storm.
Rishikesh	16th March	Hailstorm	6	Roads remained blocked for 3 hours. Six persons died when they were struck by lightning.
Delhi	22nd March—Morning and afternoon.	Duststorm	...	A 41 m.p.h. squall in the morning dislocated traffic at Delhi airports. In the evening another squall of 50 m.p.h. blew roofs off several houses and huts. Electric supply was cut off for sometime in certain areas. One person was injured.
Kumaon hills	24th March—Evening.	Hailstorm	...	The storm was accompanied by heavy rains. The hailstones caused a lot of damage to standing crops.
Margherita (Assam)	30th March.	Nor'wester.	1	Wind speed in squall reached 50 m.p.h. Trees were uprooted, window panes smashed and tiled roofs pierced. Falling trees killed a child and injured another person, and damaged a railway engine; crops and tea bushes in an area of nearly 20 sq. miles were damaged by hailstones which were reported to have been of the size of eggs.
Trivandrum and neighbourhood	4th April—Evening.	Thunderstorm	6	Trees in certain areas were burnt out by lightning. Lightning was also reported to have killed 6 persons and injured 8 persons.
Jhala village (near Gangotri)	4th April	Hailstorm	...	Many trees were uprooted. Two temples and 19 houses were blown off.
Ratnagiri and neighbourhood	13th April—Evening.	Thunderstorm	...	The coastal steamer service at Ratnagiri port was disorganised. Several persons were injured and over 100 houses damaged in a nearby village. The mango crop of the year was damaged seriously.
Poona	14th April—Evening.	Hailstorm	...	Wind speed during squall reached 30 m.p.h.
Calcutta	14th April—Evening.	Nor'wester	...	The roof of the control tower at Dum Dum was blown off by a 64 m.p.h. squall. The nor'wester also uprooted a number of trees and caused some damage to refugee hutments. The squall, followed by a hailstorm, brought down the day's temperature by about 27°F from the maximum of 103°F.

Place	Date and time	Classification of storm	Loss of human life	Remarks
Balurghat	21st April—Midnight.	Nor'wester	1	The village postmaster was killed in a house collapse. Several persons were rendered homeless.
Dergaon (Sibsagar dist.)	21st April	Thunderstorm	...	Several persons were reported to be missing and more than 3,500 people rendered homeless. A large number of buildings were reported to have been levelled to the ground.
Calcutta	22nd April—Night.	Nor'wester	...	The nor'wester was accompanied by two squalls in which wind speed reached 38 and 48 m.p.h. respectively. Several buildings were damaged. Two persons were injured. Many low lying areas were flooded by heavy rain and tram services on all sections were suspended for 1½ hrs. It was also reported that lightning set fire to a small patch of macadamised road near Government house in Calcutta.
Delhi	24th April—Afternoon.	Duststorm and thunderstorm	...	There was a series of squalls between 3-15 and 8-15 p.m. the maximum wind speed reached being 56 *m.p.h.*
Calcutta	25th April—Evening.	Nor'wester	3	Three persons were killed and 50 others injured when lightning struck a cinema house. Wind speed during squall reached 61 m.p.h. Traffic was dislocated and many low lying areas were flooded. Tram services on all sections were suspended for nearly 4 hours.
Jabalpur	25th April—Evening.	Duststorm		Nearly half the city was plunged into darkness as electric poles and wires were dislocated. Some telephone lines were cut off and many trees were uprooted.
Delhi	30th April—Afternoon.	Duststorm		Wind speed in squall reached 40 m.p.h. Thick dust reduced visibility to 100 yds.
Calcutta	4th May—Evening.	Nor'wester	...	Several trees were uprooted and roofs blown off in a 57 m.p.h. squall. Temperature dropped by nearly 15°F during the storm. Tram services were suspended for 45 minutes.
Delhi	4th May—Evening.	Duststorm followed by thunderstorm.	...	Wind speed reached a maximum of 64 m.p.h. Temperature fell by 20°F during the storm.
Udamalpet	4th May	Thunderstorm	...	Roofing tiles were blown off in several places. Damage caused to buildings was estimated at Rs. 5,000.
Banaras	5th May	Duststorm	1	One child was killed and considerable damage was caused to Mango crops.
Calcutta	5th May—Evening.	Nor'wester	2	Wind speed during squall reached 68 m.p.h. Branches of many roadside trees in Calcutta broke causing traffic dislocation. The tramway service on all sections was suspended for about half an hour. Corrugated iron roofings were blown off in some places. Two persons were killed by falling trees. Traffic at Dum Dum airport was dislocated for some time. There was a 13°F drop in temperature as a result of the storm.
Sulekere (near Shimoga)	7th May	Thunderstorm	3	Four persons were struck by lightning of whom three died on the spot.
Kalna	10th May	Thunderstorm	...	24 persons were injured in thunderstorms in three villages near Kalna. 200 people were rendered homeless by house collapses. Many cattle were injured. The damage was estimated at Rs. 70,000.
Kusugal (near Hubli)	11th May	Thunderstorm	7	Severn persons died and 8 others were injured when they were struck by lightning.
Delhi	11th May—Morning.	Thunderstorm	...	The thunderstorm was accompanied by hail and squall. Wind speed in squall reached 55 m.p.h. Several trees were blown down. Temperature dropped by 14°F.
Kozhikode	13th May	Thunderstorm	1	A strong gale uprooted several trees. One person was killed and three injured—one seriously—when a building collapsed. Two native crafts were sunk in the waters close to Kozhikode. Tiles were blown off in several buildings including the All India Radio station building.
Mathurai	15th May—Evening.	Thunderstorm	...	Many trees were uprooted by the rain and the accompanying heavy winds, blocking and cutting telephone wires and electric wires in many places. Considerable damage was also caused at a local exhibition where roofings and partitions of many stalls were blown off.
Kumaon hills	16th May—Evening.	Severe hailstorm		Crops were damaged by the severe hailstorm followed by heavy rain.

Place	Date and time	Classification of storm	Loss of human life	Remarks
Vijayawada	18th May—Night.	Thunderstorm	1	A 45 m.p.h. squall uprooted several trees, blew off roofs of several hutments and caused minor damage to telegraph and telephone poles. Falling electric wires killed one and injured another. Vehicular traffic came to a standstill. Telegraph and telephone communications between Vijayawada and Madras were interruped and electric supply in several areas of the city were cut off.
Delhi	29th May—Evening.	Duststorm		Wind speed reached 40 mp.h. during squall.
Delhi	1st June—Afternoon.	Duststorm		Wind speed in squall reached 45 m.p.h. Visibility was reduced to 200 yds. and it was reported that motorists had to use headlights even at 3 p.m. Air services were affected. Temperature fell by 10°F. Several trees were uprooted dislocating traffic.
Nainital	2nd June—Evening.	Duststorm and thunderstorm	...	Electric, telegraph and telephone connections were paralysed for over an hour. Several trees were uprooted and roofs blown off. The rain which followed the duststorm flooded the city's main roads.
Delhi	2nd June—Evening.	Ditto.	...	Wind speed in squall reached 55 m.p.h. and temperature fell by 27°F from 104°F before the storm to 77°F after the storm. One person was injured by falling trees. Traffic was affected at Delhi's airports.
Moghulsarai	2nd June—Night.	Duststorm	3	Three persons were killed when a wall collapsed during the storm.
Mussooree	2nd June—Night.	Thunderstorm	...	Supply of electricity in the city failed for nearly 3 hrs. due to the thunderstorm.
Patiala	5th June—Evening.	Thunderstorm	...	The thunderstorm which was accompanied by hail uprooted many trees. Traffic was suspended for half an hour. Telegraph and telephone communications were also disturbed.
Lucknow	5th June	Duststorm	...	One building collapsed and several others were damaged. Some persons were injured.
Amritsar	21st June—Night.	Duststorm followed by thunderstorm.	10	Uprooted trees and collapsing buildings were reported to have killed 10 persons and seriously injured several others. Nearly 500 stalls belonging to refugees collapsed. Nearly 500 trees were uprooted in Amritsar city alone. Electricity and telephone systems in Amritsar city were seriously damaged, 60% of the telephones going out of order. Loss of cattle life was also reported to be heavy.

IV. WINDS OF FORCE NINE OR MORE IN THE INDIAN SEAS.

Excluding dates of storms and depression, a description of which has been given above, winds of force 9 or more were recorded on ships in the Indian Seas during the year 1952 on the following occasions :—

Date	Name of ship	Approximate position Lat. °N	Long. °E	Date	Name of ship	Approximate position Lat. °N	Long. °E
18-5-1952	Sangiorgio	5·5	83·3	4-7-1952	San Georges	13·0	55·8
18-5-1952	Sangiorgio	5·5	82·9	21-7-1952	Karanja	20·8	63·2
19-5-1952	Sangirogio	0·6	81·8	9-8-1952	W/S Alacrity	10·4	63·8
22-6-1952	Corfu	17·8	61·1	11-8-1952	W/S Alacrity	12·8	55·6
23-6-1952	Name not available	16·0	56·0	12-8-1952	W/S Alacrity	13·0	55·3
24-6-1952	Celebes	12·3	56·5	2-9-1952	Bharatrani	16·3	84·5

PUBLICATIONS OF THE INDIA METEOROLOGICAL DEPARTMENT

(Complete list, upto July 1956, including those Publications which are now out of print.)

Notes:—

1. ALL THE PRICED PUBLICATIONS EXCEPTING THE DAILY, WEEKLY AND MONTHLY WEATHER REPORTS, AND THOSE ITEMS WHICH ARE 'OUT OF PRINT', ARE AVAILABLE FOR SALE WITH THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI-8.
2. INDIAN DAILY WEATHER REPORT, WEEKLY WEATHER REPORT, AND MONTHLY WEATHER REPORT ARE AVAILABLE FOR SALE IN THE OFFICE OF THE DEPUTY DIRECTOR GENERAL OF OBSERVATORIES (FORECASTING), METEOROLOGICAL OFFICE, POONA-5.
3. DAILY REGIONAL WEATHER REPORTS FOR CALCUTTA, NEW DELHI, NAGPUR, BOMBAY AND MADRAS ARE AVAILABLE FOR SALE AT THE RESPECTIVE REGIONAL METEOROLOGICAL CENTRES.

I. GENERAL.—

Instructions to observers at the Surface observatories, Part I (1954) Rs. 3-10-0	Departmental.
Cloud Atlas, edition 3 (1945). Rs. 2-2 or 3*s.* 6*d.**	Ditto.
Tables for the Reduction of Meteorological Observations in India, Reprint of 3rd edition (1947).* Rs. 5-12.	Ditto.
Relative Humidity Tables (1937). As. 7 or 9*d.**	Ditto.
Hygrometric Tables (1000 mb.) edition 2 (1949). As. 14 or 1*s.* 3*d.*	Ditto.
Hygrometric Tables (900 mb.) edition 2 (1955). Rs. 1-14 or 2*s.* 9*d.*	Ditto.
Hygrometric Tables (800 mb.) edition 2 (1949). Rs. 2-12 or 4*s.* 6*d.*	Ditto.
Hygrometric Tables (700 mb.) 1944.	Ditto.
Hygrometric Tables, Vapour Pressure. Rs. 3-8 or 5*s.* 6*d.*	Ditto.
Saturation Temperature Tables (1942). As. 10.	K. N. Rao.
Rainfall Registration (1956).	Departmental.
Service Instructions for Part-time Observers (1952).	Ditto.
Instructions for making entries in Pocket Register and Monthly Meteorological Register.	Ditto.
Weather Code (1955).	Ditto.
Brief Weather Code (1949). Rs. 1-6 or 2*s.*	Ditto.
Aviation Weather Codes (1955).	Ditto.
Codes for reporting upper Winds and Cloud Directions (1955).	Ditto.
Code for Upper Air Reports (1955).	Ditto.
Ships' Weather Code (1949). Rs. 1-10 or 2*s.* 6*d.*	Ditto.
Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†	Ditto.
Meteorology of the Bombay Presidency (1878).	C. Chambers.
Weather and the Indian Farmer (1946).	Departmental.
Meteorology in India.	Ditto.
Kodaikanal Observatory (1901—1951). Re. 1.	Ditto.
Meteorology of Persian Gulf & Mekran coast.	B. N. Benerji

II. AVIATION METEOROLOGY.—

Meteorology for Airmen in India—	
Part I—General Meteorological features. Edition 2 (1949). Rs. 4-10 or 7*s.* 3*d.*	Departmental.
Part II—Climatology of Air Routes (1936).* Rs. 2-2 or 4*s.* 10*d.*	Ditto.
India's Climates—Summary for Airmen (1943). Re. 1 or 1*s.* 6*d.*	Ditto.
Meteorological Organisation for Airmen, M.O.A. pamphlet (1949).	Ditto.
Meteorological Conditions affecting aviation over the Northwest Frontier (1934). Rs. 1-8 or 2*s.* 6*d.*	R. G. Veryard and A. K. Roy.

III. ATLASES AND CHARTS.—

Climatological Atlas of India (1906).* Rs. 27.	Sir John Eliot.
Meteorological Atlas of the Indian seas and the North Indian Ocean (1908).* Rs. 13.	W. L. Dallas.
Monthly Weather Charts of the Bay of Bengal and adjacent sea north of the equator, showing mean pressure, winds and currents (1886).* Rs. 5.	H. F. Blanford.
Monthly Weather Charts of the Arabian Sea and the adjacent portion of the North Indian Ocean showing mean pressure, winds and currents (1888). Rs. 5.	Sir John Eliot.
Charts of Bay of Bengal and adjacent sea north of equator showing specific gravity, temperature and currents of the sea surface (1887). Rs. 1-8.	W. L. Dallas.
Daily Weather Reports and Charts of the Indian Monsoon Area for the Years 1893 to 1899, each month. Re. 1*.	Departmental.
Normal Weather and Pilot Charts of the Indian Monsoon Area for 8 a.m. for each month November 1900 to August 1908, each month. As. 4.*	Ditto.
Storm Tracks in the Bay of Bengal (1925). Rs. 3-6 or 5*s.* 9*d.**	C. W. B. Normand.
Storm Tracks in the Arabian Sea (1926). Rs. 3-8 or 6*s.**	Ditto.
Climatic Charts of India and Neighbourhood for Meteorologists and Airmen (1943).*	Departmental.
Climatological Atlas for Airmen (1943). Rs. 5-2 or 8*s.*	Ditto.
Climatological Charts of the Indian Monsoon Area (1945). Rs. 16 or 25*s.*	Ditto.

IV. CYCLONE MEMOIRS, ETC.—

Hand book of Cyclonic storms in the Bay of Bengal for use of Sailors—	
Vol. I—Text. 2nd edition (1900). Rs. 4.*	Sir John Eliot.
Vol. II—Plates. 2nd edition (1901). Rs. 1-8.*	Ditto.
Hand book of Cyclonic storms in the Bay of Bengal (Abridged) 1943. Re. 1.	Departmental.

Cyclone Memoirs—

Part I—Bay of Bengal Cyclone of May 20th to 28th, 1887 (1888). Re. 1.*	Ditto.
Part II—Bay of Bengal Cyclone of August 21st to 28th, 1888 (1890). Rs. 3.	Ditto.

* Out of print.

† Copies for the years 1875, 1876, 1878 to 1881, 1884, 1887, and 1890 are out of print.

CYCLONE MEMOIRS, ETC.—(contd.)

Cyclone Memoirs—(contd.)

Part III—Bay of Bengal Cyclones of September 13th to 20th and October 27th to 31st, 1888, and Arabian Sea Cyclone of November 6th to 9th, 1888 (1890). Rs. 5.	Departmental.
Part IV—An enquiry into the nature and course of storms in the Arabian Sea and a catalogue and a brief history of all recorded storms in the Arabian Sea from 1848—1889 (1891). Rs. 3.	W. L. Dallas
Part V—Account of three cyclones in the Bay of Bengal and Arabian Sea during November 1891 (1893). Rs. 3.*	Sir John Eliot.
Report of the Midnapore and Burdwan Cyclone of the 15th and 16th of October 1874 (1875). Rs. 3.*	W. G. Wilson.
Report of the Vizagapatam and Backergunge Cyclones of October 1876 (1877). Rs. 3.*	Sir John Eliot.
Report on the Madras Cyclone of May, 1877 (1879). Rs. 3.*	Ditto.
Winds, Weather and Currents on the coasts of India and the laws of storms, edition 2 (1942). Rs 2-2 or 3s. 6d.	Departmental.

V. CLIMATOLOGICAL TABLES, ETC.—

Five-day Normals of Maximum and Minimum Temperatures and Accumulated Rainfall (1931). Rs. 4 or 6s. 6d.	Ditto.
Five-day Normals of Pressure at 9 hrs. I. S. T. (1943). Rs. 2-2 or 3s. 6d.	Ditto.
Five-day Normals of Pressure at 18 hrs. I. S: T. (1943). Rs. 1-12 or 2s. 6d.	Ditto.
Five-day Normals of Relative Humidity at 9 hrs. I. S .T. (1944). Rs. 2-8 or 4s.	Ditto.
Five-day Normals of Relative Humidity at 18 hrs. I.S.T. (1943). Rs. 2-2 or 3s. 6d.	Ditto.
Climatological Tables of Observatories in India. Rs. 38/4/-	Ditto.
Aviation Climatological Tables (1944). Rs. 8-8 or 13s. 6d.	Ditto.

VI. SCIENTIFIC NOTES.—

Vol. I—

No. 1.	Comparison of upper gradient winds, Agra and Bangalore. Rs. 1-3 or 2s.*	Mohamad Ishaque.
No. 2.	An analysis of the Madras hourly rainfall records for the years 1865 to 1875 and 1901 to 1917. As. 9 or 1s.	V. Doraiswamy Iyer.
No. 3.	Thunderstorms of Calcutta, 1900—1926. As. 14 or 1s. 3d.*	V. V. Sohoni.
No. 4.	On temperatures of exposed rails at Agra. As. 8 or 10d.	K. R. Ramanathan.
No. 5.	Frequency of thunderstorms in India. As. 6 or 8d.*	Departmental.
No. 6.	Correlation between pre-monsoon conditions over N. W. India and subsequent monsoon rainfall over N. W. India and the Peninsula. As. 6 or 9d.	M. V. Unakar.
No. 7.	Normal monthly upper winds over eight stations in India. Rs. 1-12 or 3s.*	Departmental.
No. 8.	Monthly normal isobars and wind-roses at 0·5, 1, 2 and 3 km. above sea level over India and neighbourhood. Rs. 4 or 6s. 9d.*	Ditto.
No. 9.	Comparison of temperatures in Stevenson screens at heights of 6 ft., 4 ft. and 2 ft. As. 7 or 9d.*	K. R. Ramanathan.
No. 10.	Distribution of temperature in the lower stratosphere. Re. 1 or 1s. 9d.*	P. R. Krishna Rao.

Vol. II—

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(iii) Memorandum on the rainfall of June and July and the probable amount during August and September.
(iv) Statement of the Rainfall and snowfall of Northwest India in January, February and March.
(v) Statement of actual rainfall in the monsoon season, June to September.

XIII. REPORT ON THE ADMINISTRATION OF THE METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA (ANNUAL).—

(i) Annual Report of the Director General of Observatories on the observatories of Kodaikanal, Madras, Bombay and Alibag, accompanying their Annual Reports. As. 8.
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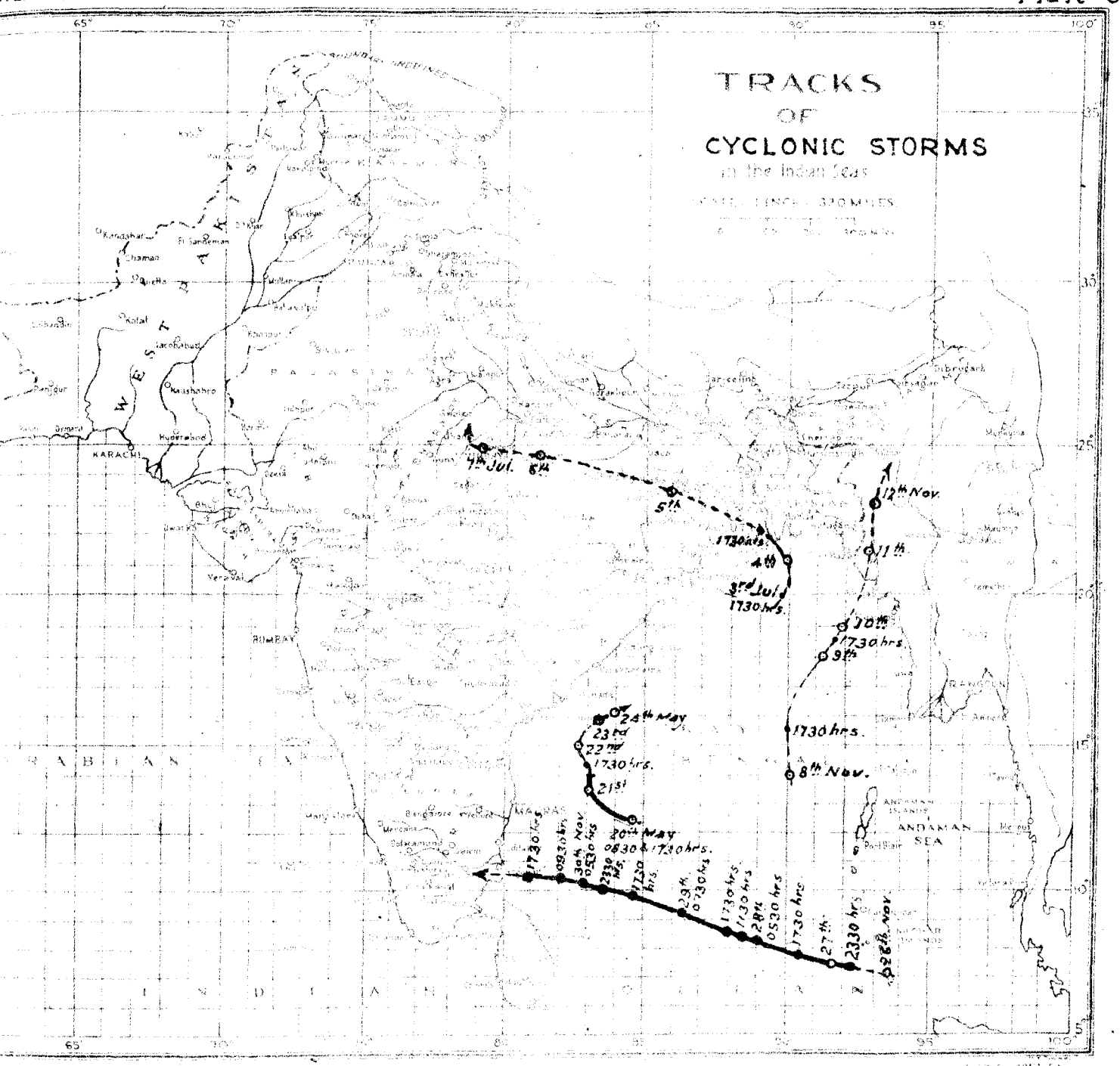

CIRCLE INDICATES POSITION OF CYCLONE OR DEPRESSION AT 0830 HRS.

------ Depression ——— Storm ——— Severe Storm

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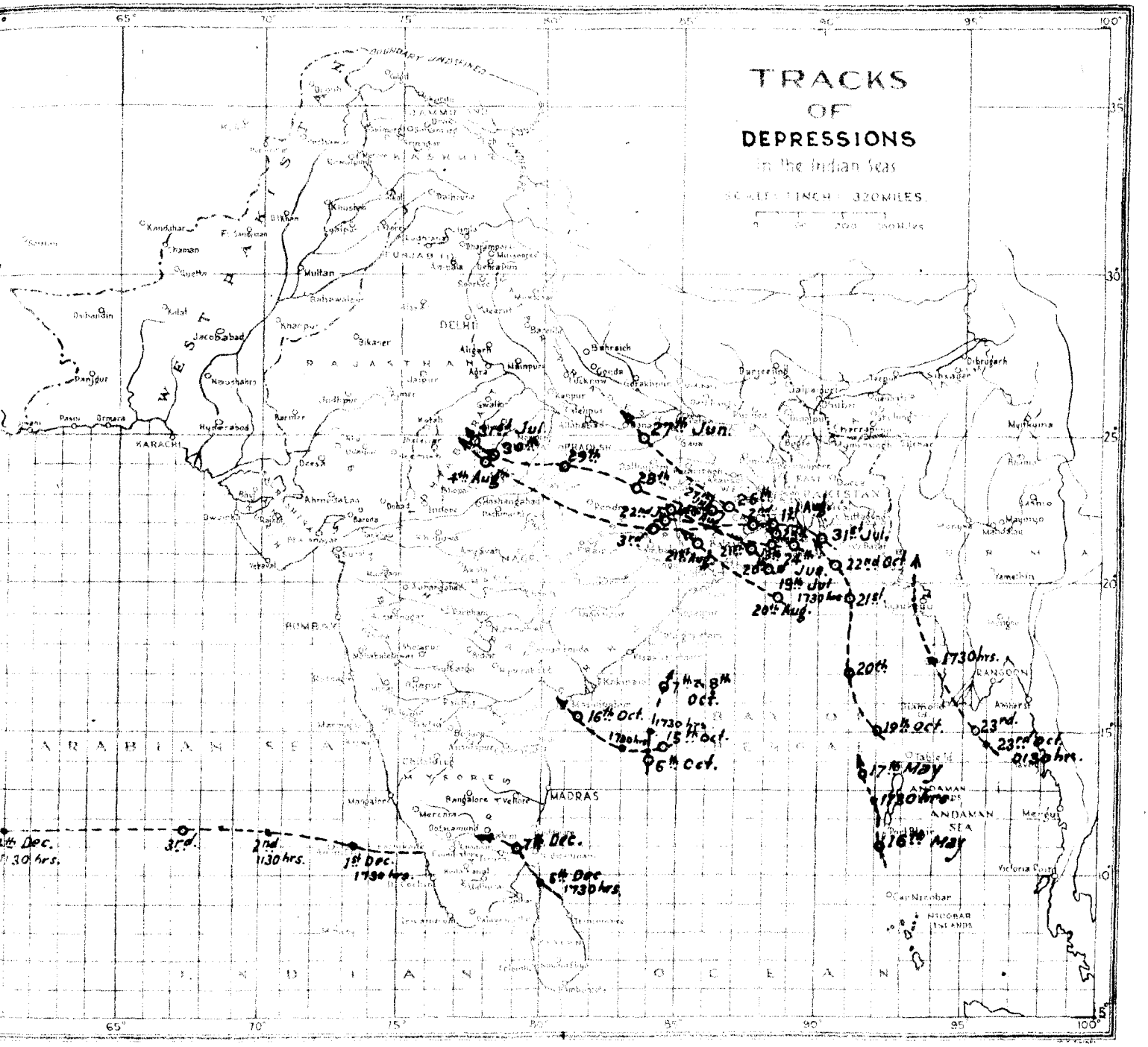

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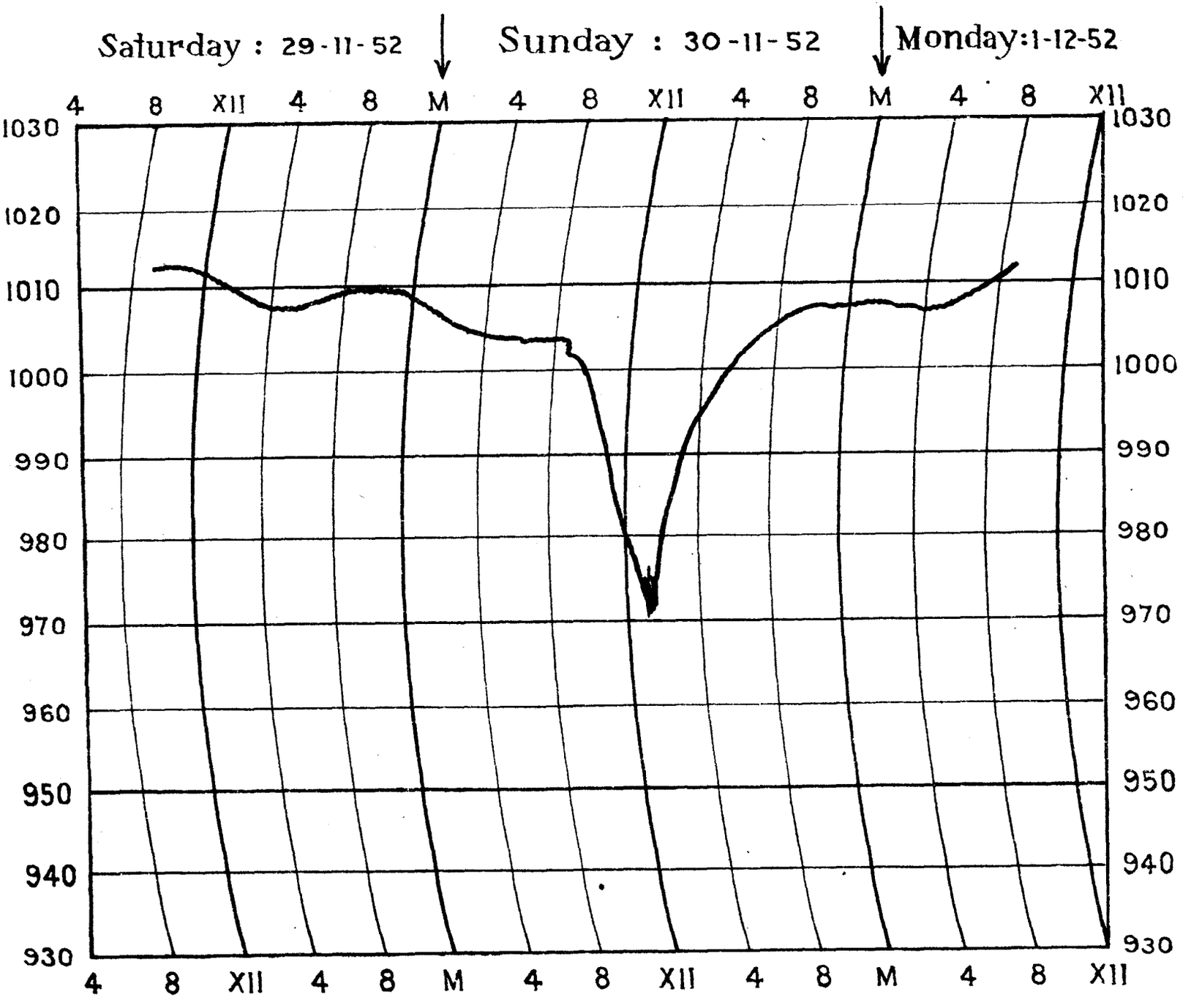

FIG. 1. BAROGRAM OF NAGAPATTINAM OBSERVATORY.

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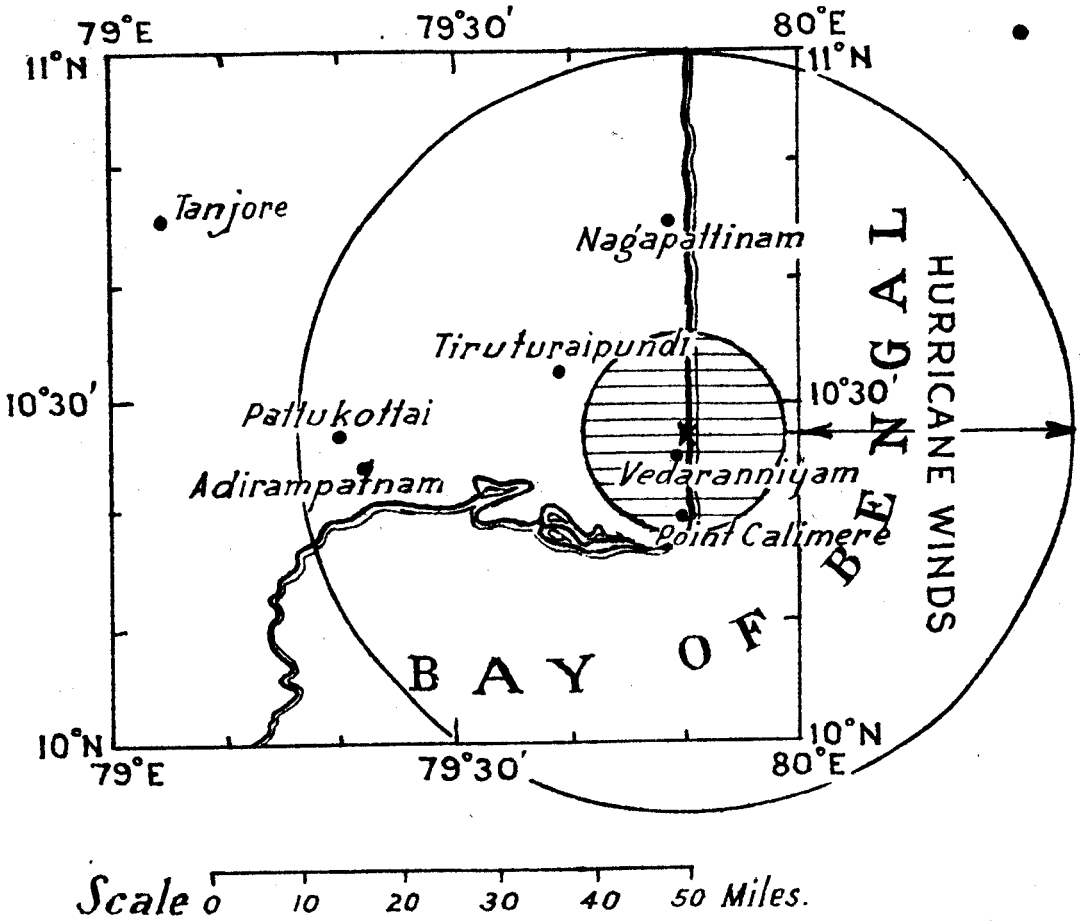

Fig. 2 : Dimensions of the "EYE" (Hatched circle) and Region of Hurricane Winds at the time of crossing the coast in the case of the severe cyclonic storm of 26th November to 1st December 1952 in the Bay.

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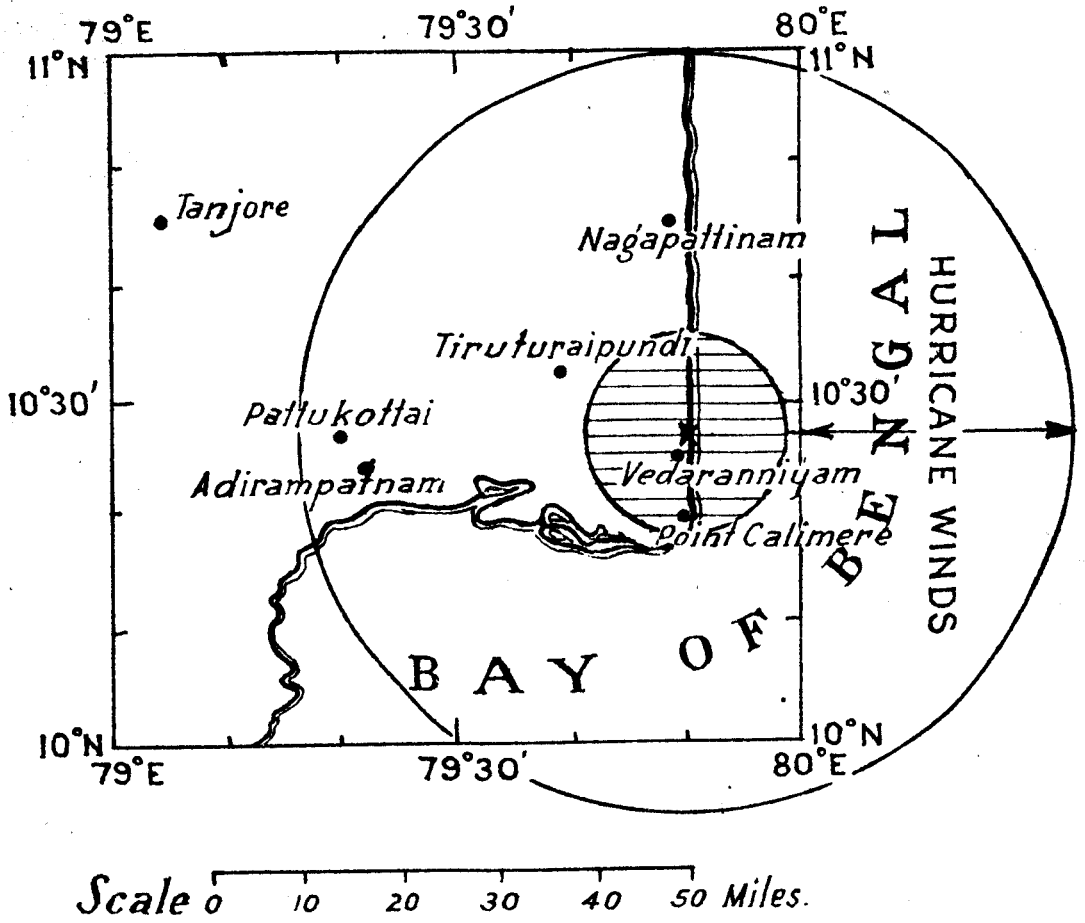

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